THE AIR CAMPAIGN VS. BALLISTIC MISSILES:

SEEKING THE STRATEGIC WIN IN THE 21ST CENTURY

BY

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A THESIS PRESENTED TO THE FACULTY OF

THE SCHOOL OF ADVANCED AIR AND SPACE STUDIES

FOR COMPLETION OF GRADUATION REQUIREMENTS

SCHOOL OF ADVANCED AIR AND SPACE STUDIES

AIR UNIVERSITY

MAXWELL AIR FORCE BASE, ALABAMA

JUNE 2017

APPROVAL

The undersigned certify that this thesis meets master's-level standards of research, argumentation, and expression.

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ACKNOWLEDGMENTS

I would like to acknowledge several people who were instrumental in helping me complete this thesis. After boring a majority of the extremely patient SAASS faculty with no less than a dozen potential thesis topics, I must express my sincerest thanks to Doctors Richard Muller and Thomas Hughes for their valuable guidance. Their combined knowledge of air power history provided ample fodder from which to pick and develop a topic of great interest to me. I owe a special debt of gratitude to Dr. Muller for his continued guidance throughout the project.

In addition to Dr. Muller, I also want to express my deepest thanks to Dr. Stephen Chiabotti. It is only through their attention to detail and patience that the prose contained herein is remotely readable.

Most importantly, I want to express my sincere appreciation to my family for their love, patience, and understanding during those times when I was absent in spirit, off struggling with this paper. Their presence was very important to me and made all the difference in ensuring my success in completing this work.

ABSTRACT

Most literature concerning the use of surface-to-surface missiles (SSMs) is focused on counter-proliferation. The authors are concerned with the emerging missile capabilities of rogue state missile arsenals. They fear that increasing ranges and accuracy will eventually threaten the US homeland. This concern is certainly warranted, but largely misses another potential consequence of enlarging SSM arsenals around the world: the threat of derailing 21st century strategic air campaigns.

This thesis explores two case studies. First it explores the Allied response to Adolf Hitler's V-weapons campaign, Operation Crossbow. It then it examines the US-led coalition's response to Saddam Hussein's Scud missile campaign, the Great Scud Chase. The cases show that while both Germany and Iraq's missile campaigns failed to win their wars for them, the campaigns did cause a significant diversion to their enemies' strategic air campaigns. Both cases also explore how the Allies and the US-led coalition were able to simultaneously accomplish their original strategic air campaigns along with their politically mandated counter-SSM campaigns. A cross-case comparison then condenses the cases' findings into two products. The first product is labeled "The Dictator's Handbook for SSM Use" whose purpose is to educate US theater planners on the possible ways that SSMs can be used to disrupt their air campaign plans. The second product is a summary of "best practices" that collects lessons learned from the counter-SSM efforts for use by both theater air planners and procurement strategists

The paper concludes by applying the "best practices" to a potential future conflict with China to highlight potential existing vulnerabilities in current theater air plans and air-platform acquisition plans.

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Introduction

This thesis examines the dynamics of surface-to-surface missile (SSM) use in response to an opponent's strategic air campaign. The purpose is to draw insights from Germany's V-weapon campaign in World War II and Iraq's Scud Campaign during Operation Desert Storm, and then apply that understanding towards US planning and procurement strategies for 21st century airpower projection.

Most research concerning SSMs focuses on the growing threat to the continental US from rogue-state ballistic missiles, or the missile threat to US overseas military bases. Both areas are of strategic importance. However, they overlook another critical area that directly affects US theater plans and airpower procurement strategies. SSM use during conflict can negatively affect an opponent's strategic air campaign by providing a powerful incentive for diverting high-value, low-density capabilities away from the main effort. The central argument is that air-campaign plans often overlook the need to consider politically sensitive SSM targets. Politically sensitive targets, once attacked, often require policymakers to divert resources to respond to the threat. The resultant ad hoc modifications to air campaigns carry the risk of strategic failure.

Two previous SSM campaigns will undergo analysis in an effort to reveal the mechanisms at play in the central argument. Specifically, Chapter 1 will explore Adolf Hitler's use of his V-weapons in World War II and the Allies' response in the form of Operation Crossbow. Chapter 2 will examine Saddam Hussein's Scud campaign and the US-led coalition's response—the Great Scud Chase. Chapter 3 will provide a cross-case comparison of the two case studies. Its output will take two forms. The first output will be labeled "The Dictator's Handbook for SSM Use." The Handbook will, in an engaging manner, serve to summarize the principles of effective SSM use. Its purpose is to afford US military strategists a peek behind the curtain concerning the potential strategies available to SSM-equipped adversaries. The second output in Chapter 3 is a summary of "best practices". This list will encapsulate the most effective methods used to overcome diversions caused by SSM use. Finally, Chapter 4 will apply these best practices to a potential future conflict between the US and an SSM-wielding opponent. This exercise

will highlight potential vulnerabilities in current US theater planning and procurement strategies, and outline implications for 21st-century airpower projection.

Terminology, Assumptions, and Methodology

Regarding terminology, the terms "missile" and "SSM" are used to describe a variety of weapons to include the V-1, V-2, and Scud. The use of the term Scud, in reference to Saddam Hussein's SSM arsenal, should be interpreted as including the SS-1/Scud short range ballistic missile, and his indigenously produced variants, the Al-Husayn and the Al-Hijarah missiles. These three variants of the Scud were the primary SSMs Hussein used in Desert Storm.[1]

Other significant terms employed in the study include those presented, or derived from, Robert A. Pape's work on military coercion strategies. First, "punishment" attacks seek to coerce by threatening civilians. Aerial bombardment of a city targeting civilian morale is an example of a punishment attack. Second, "denial" attacks seek to coerce by threatening military failure. Aerial bombardment of an adversary's army brigade to remove military forces from the war is an example of a denial attack.[2] Last, "punitive denial" attacks seek to bring about military failure through threats to civilians. Attacks against a civilian habitation to depopulate and expose insurgent forces is an example of a punitive denial attack.[3]

Several assumptions are critical to the proposed argument. The first assumes that ground forces are unable, or politically unusable, to prevent SSM launches. The second assumes that suppressing fixed SSM launch sites and locating mobile ones will remain a time- and resource-intensive task. Advances in technology may erode this assumption over time. However, there are two reasons that this assumption will have staying power. First, in the information age, any advances in locating mobile SSM sites will likely be a temporary technical offset at best. The belligerent using SSMs will have a strong incentive to develop countermeasures if his strategy is reliant on such use. Second, the mechanism explained in this thesis is well suited for SSMs, but missiles are not the only

[1] Mark E. Kipphut, "Crossbow and Gulf War Counter-SCUD Efforts: Lessons from History" (Air University, Maxwell Air Force Base, Alabama, April 1996), 34.
[2] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press, 1996), 7.
[3] Edward B. Westermann, "The Limits of Soviet Airpower: The Bear versus the Mujahideen in Afghanistan, 1979-1989" (School of Advanced Airpower Studies, Air University, 1997), 4.

weapons that can play such a diversionary role. Any weapon that suits the conditions listed in the "Dictator's Handbook for SSM Use" should succeed in enacting the mechanisms described throughout this thesis. For example, unmanned aerial or sea vehicles could perhaps substitute for or accompany missile use, and thereby negate gains in mobile-SSM-launcher detection.

The argument's methodology employs a structured, focused comparison of the two case studies. The framework applied to each consists of the following questions:

1. What were the desired objectives of SSM use?
2. Why were SSMs selected for use?
3. What results did SSM use achieve?
4. Why did actual results differ from desired objectives?
5. What unintended effects, if any, did SSM use achieve?
6. Which SSM targets yielded the best effects and why?
7. Were the unintended effects of SSM use recognized and exploited? If so, how and what was most effective?
8. Was the use of SSMs cost effective? Why or why not?

Other Notable Case Studies

Hitler's V-weapon and Saddam's Scud campaigns were not the only significant missile wars, but they consist of two out of the three missile wars against an asymmetrically dominant air power that have taken place to date. The Yom Kippur War (1973) is the third missile war in this category. The "Dictator's Handbook for SSM Use" will incorporate insights from the Yom Kippur War alongside those of World War II and Desert Storm. The Yom Kippur War was not considered for a full-length case study for two reasons. First, missiles used by the Arabs in 1973 were so poor that most missed their targets. Ascertaining their true targets, and the Arab missile-employment strategy, amount to little more than a guessing game. Second, while the Israeli Air Force (IAF) eventually escalated the war after the use of Arab SSMs, it is unclear if their actions were ever correlated to SSM use.[4] In other words, it is difficult to determine if the Arabs failed

[4] Navias Martin S, *Going Ballistic: The Build-up of Missiles in the Middle East*, 1st English ed (London ; New York: Brassey's, 1993), 127–32.

to provoke a response by air or if the IAF's escalation was, in part, a response to SSM use.

Other significant missile wars, in terms of quantity used, include the Iran-Iraq War and the Soviet-backed Afghanistan government versus the Mujahideen. The Iran-Iraq war was not considered as a case study because neither belligerent possessed a significant airpower advantage. More importantly, neither wide waged a strategic-air campaign of enough scale to draw useful insights on the effect of SSM use on air campaigns. The Afghan regime's use of Scuds against the Mujahideen was not considered as a case study because the Mujahideen lacked an air force.

Next, in the first of two case studies, is the examination of Adolf Hitler's V-weapon campaign against the Allies in World War II. It should provide insight on how Hitler's SSMs threatened to derail the Allies' strategic air campaign and how the Allies were able to mitigate the V-weapons' diversion.

Chapter 1

Operation Crossbow

The purpose of this chapter is to investigate the mechanisms at work that caused Adolf Hitler's V-weapon campaign to influence the Allies' strategic air campaign. The chapter will explore Hitler's desired objectives of his missile campaign, and attempt to determine why the actual results departed from the desired ones. Following that analysis, the chapter extracts the most and least effective aspects of Hitler's missile campaign.

Hitler eventually prioritized his V-weapon programs with three strategic goals in mind: 1) obtain a decisive effect on London and its decision makers, 2) retaliate against the British night bombing of German cities, and 3) boost the German people's morale through propaganda promoting his "miracle" or "vengeance" weapons.[1] Ultimately, the decision to use the V-weapons was made as a last resort and in an effort to avoid the Allied terms of unconditional surrender. The V-weapons provided a convenient technical fix to Germany's increasingly dire strategic situation by providing a means for a strategic offensive.

By attacking London, Hitler meant to influence the English decision makers to withdraw or reduce their support for the Allied effort. He intended to sow dissension and exploit different levels of war-weariness among Allied nations, specifically between the United States and Britain.[2] Hitler sought a punishment strategy to harass London's civilian population in an effort to provoke unrest. He intended to coerce Britain's democratically elected decision makers to reduce Britain's role in the war.

Germany's V-weapon attacks on Antwerp were an attempt to blunt the Allied continental invasion. The attacks on the continent sought a denial strategy that was meant to refuse the Allied invasion force a suitable supply port by attacking the docks at Antwerp.[3]

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[1] Oral History Interview of Reichminister Albert Speer Interview No. 11, 22 May 1945, Call # 137.315-11, IRIS # 00113506, United States Strategic Bombing Survey, AHRA, Maxwell AFB AL.
[2] *Report on Continental Crossbow*, 12-26 Feb 1945, Call # 505.42-12, IRIS # 00206048, Supreme Headquarters Allied Expeditionary Forces, AHRA, Maxwell AFB AL, 12.
[3] *Report on Continental Crossbow*, 16.

Hitler's punishment and denial coercion strategies failed because of a variety of factors. Some of these factors were borne of German decisions, and others by Allied reactions to the V-weapon threat. To fully appreciate the nuanced relationship among factors it is necessary to briefly identify applicable areas of context. To start, the next section will explore why Hitler chose to prioritize his V-weapons when he did in his war effort, and why he thought they would achieve his strategic goals.

What Hitler's V-weapons Were Meant to Accomplish

Hitler thought his V-weapons would provide an offensive capability that he otherwise lacked. This assertion begs the question--why was Hitler forced to resort to his V-weapons to take the offensive against his enemies to the west? The short answer is that all other means were either unsuitable, previously abandoned, or incapable. The German Navy was unsuitable to truly take the offensive against the flood of Allied industrial might. The best it could accomplish was to continue to prosecute its U-boat campaign until the U-boats were decisively defeated in May 1943. The German Army was certainly employed against the Allied invading ground forces. However, it lacked the capability to strike offensively against US and British strategic targets. Further, plans to launch an invasion of Britain, Operation Seelöwe, had been abandoned after the German failure during the Battle of Britain. Finally, the Luftwaffe had proved incapable of providing the strategic strikes Hitler sought during the war. First, the Luftwaffe had failed to accomplish a successful strategic-bombing campaign during the Battle of Britain. As a result, it lost air superiority over the English Channel, lost much of its medium-bomber fleet and pilots, and had prompted the rapid strengthening of British anti-air defenses. Of note, German bomber pilots took two years longer than fighter pilots to produce.[4] Second, the Luftwaffe lacked a heavy, or strategic, bomber fleet capable of penetrating strong defenses. Of all the capabilities that the German war machine possessed and those it wanted, the lack of a strategic-bombing capability would be the dominant factor in prompting Hitler to fund and employ the V-weapon program. If the German navy proved unsuitable and a land invasion had been abandoned, the failure of the Luftwaffe to conduct successful strategic bombing is the prime area to

[4] Stephen Bungay, *The Most Dangerous Enemy: A History of the Battle of Britain*, (London, UK: Aurum Press, 2015), 41.

explore. Doing so should provide insight as to what Hitler meant to accomplish with his V-weapons.

The relationships between key political and military leaders in the Luftwaffe was tenuous at best, and at worst spurred the inability of the German air force to take the fight to its enemies. The result of competing interests and conflicting personalities was an air force that contained rotten streaks to its core. Placing the blame on one individual or relationship is an elusive exercise that has proved near fruitless to this author. However, what has clearly revealed itself during the course of research is that German civilian and military air leaders' interactions provided infertile ground for Luftwaffe success. First, this essay will briefly address some of the more prominent characters at fault. Second, it will view some of the results of their flawed interactions.

Prominent characters involved in the failures of the Luftwaffe include Adolf Hitler, Hermann Göring, Ernst Udet, and Erhard Milch. First, Göring, the Luftwaffe Commander-in-Chief, held a unique relationship with Hitler. Göring attempted to please Hitler's seemingly fickle tastes in types and quantity of aircraft. This is evidenced in personal interviews conducted during the United States Strategic Bombing Survey. Göring personally admitted to allowing the Führer weigh in on all levels of Luftwaffe decisions. For example, Göring allowed Hitler to choose the mission for their revolutionary Me-262 jet fighter. Hitler selected its mission as fighter-bomber, when a defensive fighter would likely have been more appropriate in the face of an invading Allied land and air force.[5] With respect to procuring heavy bombers and the quantity of aircraft, Göring made a revealing admission that "the Führer will not ask how big the bombers are, but how many there are."[6] Hitler wanted to expedite creating a large striking force versus building a strategically diverse force with depth in reserve.[7]

Göring's statements are revealing in several ways. They show his desire to appease Hitler even to the Luftwaffe's detriment. The quote about bombers showed that Hitler would sacrifice a fully developed product in an effort to get more new weapons to the front faster. This tendency would further haunt Hitler while pursuing his V-2

[5] Oral History Interview of Reichsmarschall Herman Göring, Interview No. 56, 29 Jun 1945, Call # 137.315-11, IRIS # 00113506, United States Strategic Bombing Survey, AHRA, Maxwell AFB AL.
[6] Bungay, *The Most Dangerous Enemy*, 45.
[7] Bungay, *The Most Dangerous Enemy*, 40.

program. Hitler's and Göring's obsession with producing quantity over quality can largely be attributed to promoting the deterrent propaganda effect of the Luftwaffe. To both, the Luftwaffe was as much a political weapon as a military one.[8]

The relationship between Göring, Milch, and Udet is also revealing. Despite Göring being in charge of the Luftwaffe, Milch, the Secretary of State for Air, was initially placed in charge of rapidly expanding the air force shortly after it was stood up in 1935.[9] However, by 1937 Göring increasingly viewed Milch as a threat and thus appointed Udet, an old flying friend, as Chief of Technical Air Armament.[10] This action undermined Milch's competent technical and administrative skills. Like Göring, Udet, was largely regarded as a fellow "romantic amateur" possessing a Red Baron-inspired neglect of technology in favor of a World War I knight-of-the-air mystique.[11] The result of inadequate oversight and a lack of technological understanding by Udet was a Luftwaffe that possessed state-of-the-art aircraft at the start of the war, but was quickly outclassed by failing to develop follow-on generations.[12] This concludes the examination of the major German civilian and military air leaders' relationships. The takeaway is that conflicting priorities made strategic decisions on procurement difficult, and this had lasting effects on the Luftwaffe that Hitler would have at his disposal come wartime.

The list of critiques against the Luftwaffe during World War II is too long to address. However, there are some compelling issues that resulted from the mismanagement of procurement leading into the war. The following passages will attempt to address the most pertinent of those reasons in an effort to explain exactly why Hitler was left with a large asymmetric disadvantage in strategic-bombing capabilities.

First, the mismanagement of Luftwaffe procurement during the interwar period led to a lack of centralized control over the research, development, and manufacturing of German warplanes. Lack of centralization led to the Luftwaffe developing eighty-six

[8] Bungay, *The Most Dangerous Enemy*, 35.
[9] Bungay, *The Most Dangerous Enemy*, 37.
[10] Richard Muller, *The German Air War in Russia* (Baltimore, Md: Nautical & Aviation Pub. Co. of America, 1992), xi.
[11] Bungay, *The Most Dangerous Enemy*, 41.
[12] Muller, *The German Air War in Russia*, 230.

different aircraft designs during the war.[13] With so many different designs, the already-limited German aircraft industry was unduly taxed. So many designs and a lack of centralized control led to redundancy and non-optimal use of precious resources. Without proper focus on a few promising designs, overall advancements in technology suffered. The end results was a smaller and less capable air force than what could have been.

Second, the lessons of the German Legion Condor during the Spanish Civil War combined with technical deficiencies influenced bomber-aircraft design. Further influencing German aircraft design were the lingering effects of the Treaty of Versailles. The treaty restricted German warplane production. On one hand, the limits on aircraft production produced a lively rocket and gyro culture in Germany that played a necessary hand in V-2 development later on.[14] On the other hand, the treaties had lasting negative effects on the aircraft industry, affecting such aircraft technologies as engines and bomb sights.[15] Moreover, the Legion Condor in the Spanish Civil War left lasting impressions with Luftwaffe leaders. One particular example became a major lesson. It involved the attempted bombing of a road bridge in the town of Guernica. The German bomber pilots realized that striking a small target was difficult and thus resorted to attacks in the general area of the target, creating much collateral damage that included civilian deaths. The lessons of the Spanish Civil War combined with dreadful results during high-altitude horizontal-bombing practice in the German training wings led the German air chiefs to favor the more accurate technique of dive bombing.[16] Subsequently a dive-bombing dogma developed in the Luftwaffe largely due to Udet's effort.[17] Thus, the legendary "Stuka" dive-bomber was born as the Ju 87.[18] The persistence of the dive-bombing

[13] Bungay, *The Most Dangerous Enemy*, 46.
[14] Donald Mackenzie, *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance* (Cambridge, MA: The MIT Press, 1990), 44.
[15] Muller, *The German Air War in Russia*, 4.
[16] Edward L. Homze, "The Luftwaffe's Failure to Develop a Heavy Bomber Before World War II," *Aerospace Historian* 24, no. 1, March 1977, 24.
[17] Oral History Interview of Lieutenant General Karl Koller, Interview No. 8, 23-24 May 1945, Call # 137.315-8, IRIS # 00113503, United States Strategic Bombing Survey, AHRA, Maxwell AFB AL.
[18] Bungay, *The Most Dangerous Enemy*, 39 and 47.

dogma yielded direct influence on the types of bombers the Luftwaffe procured before and during the war, and partially accounts for the lack of heavy, long-range bombers.

Third, Germany's unique geography had some hand in aircraft design and procurement. Particularly, if one looks to Germany's western front, there exists no real need for a heavy, strategic bomber fleet. Advances west along the continent could, and in fact were, accomplished by a largely combined-arms, blitzkrieg-style fleet. Bomber runs against Britain could be accomplished, in theory, with medium-range bombers.[19] So, in part, Germany's geography likely played a part in German aircraft procurement. Its geography does not, however, explain Germany's lack of a strategic-bomber fleet when one looks to its eastern front.

Fourth, along Germany's eastern front there existed a need for a strategic-bomber fleet, but other issues within the Third Reich limited their production. The German war machine had its strategic-bombing proponents. Interwar Defense Ministry official, Hans von Seeckt and the first Chief of Staff of the Luftwaffe, General Walther Wever, both held the view that the Air Force should acquire a capability to act independently, but in harmony with, the other services in carrying the war against the industrial capacity of the enemy.[20] This capability to attack deep-seated industrial capabilities of an enemy would have been ideal for Germany's invasion of Russia during World War II. However, possession of a heavy bomber fleet was stymied due to technological issues, a lack of industrial capacity, and resource misprioritization.

The Treaty of Versailles and fleeing of many German scientists pre-war led to technological issues in the aviation industry. These technological issues delayed large-scale production of a German strategic bomber. The first generation of four-engine bombers, the Ju 89 and the Do 19 were widely regarded as too underpowered and lacking in overall performance and thus never made it to production.[21] The Treaty of Versailles and its negative influence on aircraft-engine design had struck again.[22] Follow-on generations of heavy bombers included the Fw 200, Ju 290, and the He 177. The Focke-

[19] J. Adam Tooze, *The Wages of Destruction: The Making and Breaking of the Nazi Economy* (New York: Penguin USA, 2008), 341.
[20] Muller, *The German Air War in Russia*, 4–7.
[21] Muller, *The German Air War in Russia*, 9.
[22] Muller, *The German Air War in Russia*, 4.

Wulf and Junkers models were never pursued after initial research and development. They were both converted airliners, and as such, were likely never meant to populate the Luftwaffe's bomber fleet in mass.[23] The Heinkel He 177 was probably the Nazis' best chance at claiming a viable strategic bomber. However, the He 177 suffered from two substantial setbacks. First, to overcome the underpowered German engines, the designers of the He 177 mounted two tandem engines that drove one propeller. This design was prone to catch on fire. Second, the Luftwaffe dive-bombing dogma led the General Staff to demand that the He 177 be built to withstand 60-degree diving attacks. The resultant structural modifications to withstand the new requirement increased weight on an already-underpowered platform.[24] Both issues with the He 177 delayed manufacture and prevented mass production of a suitable version in enough time to use it during the war.[25] A lack of technologically shrewd people and problems with Germany's industrial capacity did not help the matter either. Many of Germany's scientists left in the 1930s as Nazi ambitions began to take shape.[26] As for the lack of Germany's industrial capacity, that is a story in and of itself.

Competing resource priorities represented another important limiting factor to German heavy-bomber development. Minister of Armaments and War Production, Albert Speer, admitted that Hitler often prioritized resources to the Army and relied on World War I munitions estimates.[27] When considering the different context and technologies brought to bear in World War II vs the Great War, one can see why Hitler's estimates posed a problem. His priorities became a self-fulfilling prophecy once he opened up a second front to the east. The second front created several implications regarding resources. Most obviously, two fronts required more resources than one. More resources required further expansion of the war fronts. Further expansion fueled further requirements for ground resources. As a result, resources devoted to air-specific programs not in support of the ground effort was given lower priority. At one point in the

[23] Oral History Interview of Major General Christian, Interview No. 18, 19 May 1945, Call # 137.315-18, IRIS # 00113516, United States Strategic Bombing Survey, AHRA, Maxwell AFB AL.
[24] Homze, "The Luftwaffe's Failure to Develop a Heavy Bomber Before World War II," 24.
[25] Koller, Christian, and Speer Interviews.
[26] Bungay, *The Most Dangerous Enemy*, 41.
[27] Oral History Interview of Reichminister Albert Speer Interview No. 65, 13 Jul 1945, Call # 137.315-65, IRIS # 00113563, United States Strategic Bombing Survey, AHRA, Maxwell AFB AL.

war, heavy bombers were seventh in priority for resources after tanks, U-boats, artillery, locomotives, V-weapons, and munitions.[28] One should note the V-weapon taking higher priority than the heavy bomber. This prioritization was a result of the delays in the He 177 program previously discussed, and leads us into the discussion on why Hitler chose to pursue the V-weapons.

Hitler resorted to his V-weapons program out of necessity if he was going to achieve his strategic goals of 1) obtaining a decisive effect on London and its decision makers, 2) retaliating against the Allied night bombing of German cities, and 3) boosting the German people's morale with propaganda of the use of offensive weapons. Issues procuring a heavy bomber that could fight its way over London or to the US prevented a German strategic-bombing campaign. The growing effectiveness of the Royal Air Force (RAF) Fighter Command and the sheer distance to the US from German-occupied airbases prevented Germany's remaining medium bomber fleet from conducting a strategic bombing effort. Land and sea forces could not achieve his strategic objectives. Germany's strategic situation placed Hitler in a position from which he desired a technological fix to his problems. The V-1 and V-2 weapons met his aspirations. Hitler thought the V-weapons could shift the German war effort's emphasis back to the offensive against strategic targets in Britain, and perhaps in the near future the United States. In theory both weapons could substitute for a heavy bomber fleet. The V-1 could sidestep resource-shortage issues, and the V-2 could penetrate even the best defenses the RAF had to offer. Finally, V-1 and V-2, or Fi-103 and Aggregat 4 (A-4) as they were initially named, were relabeled the Vergeltungswaffe 1 and 2, respectfully. The V-weapons had been designated as "Vengeance Weapon 1 and 2" to help achieve Hitler's propaganda objective.[29] By promising a technological fix to Germany's strategic problem, the V-weapon program eventually elicited a high-enough priority for resourcing. Research and development on missiles had been ongoing in Germany since the 1920s, so why did Hitler wait until so late to fully fund their employment?

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[28] Oral History Interview of Dr. Kurt Tank, Interview No. 1, 19 May 1945, Call # 137.315-1A, IRIS # 00113494, United States Strategic Bombing Survey, AHRA, Maxwell AFB AL.
[29] Walter Dornberger, *V-2*, trans. James Cleugh and Geoffrey Halliday (New York, NY: Viking, 1954), 108.

Progress in the field of rocketry was promising in Germany long before the start of World War II, but substantial resourcing with the intent to weaponize did not occur until 7 July 1943. Germany's defeat in World War I and the subsequent restrictions on its war production fostered a rocket and gyro culture in the 1920s and 1930s.[30] With his rise to power, Hitler became aware of the guided-missile technology the Army was funding. In March of 1939 he visited the experimental station at Peenemunde. After watching several rocket-motor test burns, the institution's commanding officer, General Walter Dornberger, noted that Hitler seemed uninterested. That meeting made a lasting impression on Dornberger who previously took the Führer as a man who "showed the greatest interest in all new weapons."[31] Speer showed some interest after a successful V-2 demonstration on 3 October 1942. However, Hitler remained unenthusiastic. He foresaw the limited effect that the V-weapons would produce if not employed in mass. He stated that 5,000 V-2s would have to be launched simultaneously to achieve decisive effects.[32] Further, in March of 1943, he even dreamed that "no A-4 will ever reach England."[33] Yet, by 7 July 1943 the V-programs had received the top priority in the armaments program.[34] What had changed? In short, Hitler's strategic environment had changed for the worse.

In the six months preceding Hitler's decision to prioritize the V-weapon program, many significant milestones in the war had been reached. In January of 1943 the Allies had conducted the Casablanca Conference. The Allies had agreed to press Germany for unconditional surrender. This demand alone possibly resulted in many of Hitler's seemingly desperate decisions. Also following the conference, the Combined Bomber Offensive (CBO) was beginning to show results, evidenced by the successful Battle of the Ruhr that started in March.[35] Late 1942 also saw Rommel's retreat through Africa and the flagging morale of Italian leader Benito Mussolini. But, the most notable hit to

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[30] Mackenzie, *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance*, 44–45.
[31] Dornberger, *V-2*, 67.
[32] *The "Crossbow" Campaign: The Air Offensive Against the V-Weapons*, 24 Sep 1945, Call # 137-3-6-13, IRIS # 00113322, Unites States Strategic Bombing Survey, AFRHA, Maxwell AFB AL, 10.
[33] Dornberger, *V-2*, 91.
[34] Dornberger, *V-2*, 99.
[35] Tooze, *The Wages of Destruction*, 597.

the German war effort was the loss of the German 6th Army in February 1943 during the Battle of Stalingrad. The momentum of the war had slowly shifted against Hitler by the time he finally prioritized the V programs. Why, however, in the face of ever scarcer resources, did Hitler choose to fund both the V-1 and V-2 programs?

The V-1 and V-2 were both chosen for funding for several reasons and were not the only V weapons to receive resources. Of note the V-3 was also funded. It was roughly equivalent to the modern day rail gun, but development never came to fruition before the Allies gained control of its development facilities. The V-1 program gathered steam after the Luftwaffe's disastrous Battle of Britain performance. It was the German air force's attempt to compete with the Army's V-2 program in an effort to prevent a pilot-less aircraft offensive without them.[36] Both programs were chosen for development and employment because their strengths and weaknesses offset each other. The V-1 offered a relatively simple, cheap, fuel efficient weapon that consumed few resources to produce. However, it required time to build semi-transportable launching sites that were easily vulnerable to air attack. The weapon was slow enough to be defended against by fighter, anti-aircraft fire, and balloon barrages. The mobile V-2 launch sites, on the other hand, were nearly undetectable by air until after launch. Their high speed ballistic reentry was indefensible and added kinetic punch to the warhead. However, the V-2 development was a complex task and suffered years of technical delays. Its fuel consisted of liquid oxygen and alcohol which were difficult to produce in quantity, store, and transport. The cost of the V-2 is debatable and will be discussed later in depth, but is generally regarded as approximately 20 times that of a V-1.[37] Despite offsetting each other's weaknesses, each weapon came with strategic flaws. Combined with other external factors, these flaws were enough to keep the V-weapon program from bringing Hitler success. Yet, pursuing both weapons seemed like a winning combination to confront Germany's increasingly dire situation.

In sum, Hitler thought that the V-weapons were the appropriate technical fix to his strategic predicament by July 1943. The V-1 and V-2 would help achieve decisive

[36] Phillips Payson O'Brien, *How the War Was Won: Air-Sea Power and Allied Victory in World War II* (Cambridge, United Kingdom: Cambridge University Press, 2015), 31.
[37] Dornberger, *V-2*, 94–95.

effects over London through a punishment campaign, and blunt the Allied invasion through a denial campaign against Antwerp. With the London attacks Hitler sought annihilation of enough of London to turn the war's momentum back in his favor.[38] The Antwerp attacks were likely born out of desperation, but meant to deny the advancing Allied forces a critical resupply line of communication at the Antwerp docks. Next, the chapter explores what actually happened with Hitler's use of the V-weapons in an attempt to draw out the true mechanisms at work in his missile campaign.

What Hitler's V-weapons Actually Accomplished

Hitler's V-weapons did not turn the war in his favor. Obviously, Germany lost World War II, thus the V-1 and V-2 in some ways were strategic failures. This section will attempt to discover what the actual effects of the V-weapon attacks were, as well as explore why they failed to achieve the desired aims. Several factors are at play that led Hitler to predict a different outcome than what occurred through the use of his miracle weapons. To begin analysis as to why, it is first necessary to take account what the Allies did to respond and what exactly the V-weapons achieved.

"It seemed likely that, if the German had succeeded in perfecting and using these new weapons six months earlier than he did, our invasion of Europe would have proved exceedingly difficult, perhaps impossible…Overlord might have been written off," stated General Dwight D. Eisenhower, Supreme Allied Commander of the Allied Expeditionary Forces in Europe.[39] The German V-weapon program prompted the Allies to initiate Operation Crossbow in response. Crossbow was the name given to all aspects of the missions taken against V-weapon sites, codenamed Noball sites. The official view of the effectiveness of Crossbow bombing as relayed in the United States Strategic Bombing Survey (USSBS) is that the operation delayed and reduced, but never eliminated the V-weapon attacks. Allied ground forces' control of Noball sites were the only reason they stopped firing permanently. The USSBS estimated that bombing delayed the start of V-1 attacks by 3 months, and delayed the V-2 attacks by 6 months.[40] The delay of 6 months, if accurate, could have denied the strategic turning point Hitler sought. In Eisenhower's

[38] Dornberger, *V-2*, 104–5.
[39] Dwight D. Eisenhower, *Crusade in Europe* (New York, NY: Doubleday & Co., 1948), 260.
[40] *The "Crossbow" Campaign",* 2.

view, V-2 attacks against London before Operation Overlord commenced may have successfully coerced British policymakers to yield. This counterfactual assertion is impossible to verify, thus it is difficult to truly label Crossbow as a pure success, especially in light of the mixed bombing results.

Critiques of the effectiveness of Crossbow bombing are varied. On one hand, the initial Crossbow attacks on the Peenemunde research facility largely missed the target. The USSBS states that the attacks there were too late to hamper the progress of V-weapon development.[41] Attacks against the "large" V-2 launch sites and the V-1's "ski sites" along the coast of France and Belgium were made with varying effectiveness early in the operation. Attacks on these sites merely prompted the creation of mobile launch sites that were both difficult to locate and strike from the high altitudes at which the heavy bombers operated. The mobile launch sites were easy to repair in the event they did take a direct hit and could be erected more quickly than they were destroyed.[42] The shift to mobile sites was the primary reason Crossbow could not eliminate the V-weapon attacks altogether.

Crossbow bombing did, however, have some positive outcomes. The Allied attacks at Peenemunde showed Hitler that they had some level of awareness of his secret V-weapon programs. This awareness prompted large, time-consuming, and extremely costly dispersal programs, some to extravagant underground facilities. The shift to mobile launch sites prompted the Allies to shift effort towards striking production and storage facilities. It also allowed the Allies to increase the priority of one of their more coveted targets, transportation. The mobile sites demanded an extraordinary Allied reconnaissance effort. The increased Allied air presence yielded some side benefits too. For example, upon spotting any Allied reconnaissance planes, German launch crews assumed their mobile sites had been discovered and constructed many more new sites than required.[43] Between the dispersal operations and new-site construction, it is logical

[41] *The "Crossbow" Campaign",* 5.
[42] Juliette Hennessy, *Army Air Forces Historical Study: No 70, Tactical Operations of 8th Air Force*, 1 Jan 1952, Call # 101-70, IRIS # 00467659, United States Air Force Historical Division, AFHRA, Maxwell AFB AL, 166.
[43] *Report on Continental Crossbow*, 17.

to assume that Crossbow had some hand in delaying and reducing the employment of the V-weapons. But, it was not the only reason for delays.

Dornberger, the Commanding Officer of Peenemunde, gave other reasons for V-2 employment delays. The V-2 was a complex weapon for the time that was not even intentionally created as a weapon, but as a means to test space travel. As with most technologically radical designs, it suffered its share of technical setbacks. The V-2 initially had two major flaws. It tended to break apart and prematurely explode upon its ballistic reentry. At times it also impulsively airburst shortly after launch.[44] It is difficult to assess how much of the V-weapon's delays were attributed to technical issues versus the effects of Operation Crossbow. However, it is reasonable to credit the operation with some level of delay and increased cost of employment, especially if one considers the cumulative effort of the simultaneous Allied CBO against oil and transportation targets.[45] That concludes the look at the Allied response, and now a look at what exactly the V-weapons achieved.

The V-weapons' effectiveness was relatively minor but not insignificant. Target details will be discussed in depth in the next section, but Table 1 summarizes weapon production amounts and the number of killed or injured people in both England and Antwerp. The deaths and injuries that London civilians suffered affected morale enough to elicit a response from British leaders. Physical damage to London industrial capabilities, however, was minimal. Damage to Antwerp was significant because it was closer to the launch sites which made the weapon's error smaller. However, attacks at Antwerp did not significantly hinder Allied lines of communication. The V-weapons were too inaccurate to destroy pinpoint military targets in Antwerp's case. And while they spurred a British response, the weapons were not employed in enough mass to cause widespread panic or achieve decisive results in the case of London. So, while not insignificant, the V-weapons' results can largely be assessed as less than decisive. They did, however, manage to pointedly alter the Allied air campaign, but this consequence was also not enough to prove decisive.

[44] Dornberger, *V-2*, 212–14.
[45] *The "Crossbow" Campaign",* 7.

Table 1: Summarized Comparison of Damage, V-1 and V-2

	V-1	V-2
Desired Production Amount	60,000	12,000
Actual Production Amount	30,000	6,000
Landed in England	5,890	--
England Killed/Injured	5,864/17,200	2,865/6,286
Landed in Antwerp	--	1651
Antwerp Killed/Injured	4,676/10,072	Approx. 2,000 killed
Estimated Abort Rate	20%	10-15%

Source: Adapted from the Report on Continental Crossbow, 12, 16, 20, and 29; Richard G. Davis, Carl A. Spaatz and the Air War in Europe (Washington, D.C: Center for Air Force History, U.S. G.P.O, 1993), 426; Mark E. Kipphut, "Crossbow and Gulf War Counter-SCUD Efforts: Lessons from History" (Air University, Maxwell Air Force Base, Alabama, April 1996), 12.

The V-weapons did not achieve Hitler's desired outcomes, nor did the diversion they created in the Allied air strategy prove enough to swing the tide of war in Germany's favor. There are reasons on both sides as to why. For Germany, Hitler prioritized the development of the weapons too late in the war. They did not receive top priority until July 1943. Not until this time did the V-2 receive enough manpower and resourcing to fix its technical flaws. Further, Hitler was overly optimistic about what the weapons could achieve; this was a dominant theme of air power for all sides throughout World War II. In the end the Führer placed "exaggerated hopes…in individual weapons systems and in accelerated high-risk development programmes that were made even more unpredictable by the ever-pressing constraints of manpower and materials."[46] So, while the relatively shorter-ranged V-1 was mass produced, it was rendered useless due to range after the Allies pushed the Germans' western front to the east. Even the few air launched V-1s became less effective as German-controlled airfields moved east with the Allied advances. The V-2 was delayed so long that it was never able to be mass-produced, so effective attacks in mass were never achieved.

For the Allies, the V-weapons threatened to unravel their air strategy, but they successfully dealt with the diversion of resources in several ways. With the looming

[46] Tooze, *The Wages of Destruction*, 612.

threat of the use of a secret German weapons against England, the initial Allied response tended toward overreaction. At least, in light of the post-war analysis of the V-weapons' actual effects and limited numbers, British Prime Minister Winston Churchill appeared to overact, but understandably so. After the first round of V-1s landed in London on the night of 12 June 1944, Churchill and most of London, felt an unnerving degree of anxiety. Churchill created a separate war cabinet to deal with the new threat. He also attempted an unusual degree of persuasion with the Allied generals, in particular, Eisenhower. Churchill attempted to increase the air effort directed to Crossbow. The timing of his proposed diversionary air effort could have foretold disaster, because Allied air forces were currently in the process of aiding the Overlord invasion force that had landed nearly a week prior.[47] Fortunately for the Allies, their military leaders adeptly handled the diversion of air resources, and they did so for a variety of reasons.

First, the Allied military leaders provided effective compromises that set the British leaders, such as Churchill, at ease. Commander of the US Strategic Air Forces in Europe, Carl Spaatz, was opposed from the start to the diversion of his aircraft in pursuit of Crossbow operations at the expense of the CBO effort. Instead of bombing the V-1 "ski site" launch areas, Spaatz offered to attack the German factories making the V-1 gyroscopes and storage depots further inland in France. This satisfied the requirement to attack Crossbow targets, but also produced a side benefit directly in line with main effort. Since Spaatz's suggested targets lay further inland, the Luftwaffe were more likely to oppose the bombers and their escorts. Spaatz attacked the Crossbow targets while attriting the remaining Luftwaffe fighter fleet at the same time.[48] Compromises worked the other way too, appeasing military leaders who balked at Crossbow's diversion of their air assets. Commander-in-Chief of Britain's Bomber Command, Sir Arthur Harris, was apt to make his point clear that he viewed the diversion of his aircraft in support of Crossbow as negating his efforts of the previous three years.[49] The Supreme Allied Commander in Europe, General Dwight Eisenhower understood Harris' concern, while also walking a tightrope of diplomacy and compromise with Churchill. In the end,

[47] Davis, *Carl A. Spaatz and the Air War in Europe*, 426–28.
[48] Davis, *Carl A. Spaatz and the Air War in Europe*, 428–29.
[49] Henry Probert, *Bomber Harris: His Life and Times : The Biography of Marshal of the Royal Air Force Sir Arthur Harris, the Wartime Chief of Bomber Command*, 2016, 296.

Eisenhower satisfied both parties. He remarked to Harris' that, "I hope I have never left any doubt as to my desire to return all the strategic air Forces to the bombing of Germany to the greatest possible extent and at the earliest possible moment…Of course we always have the emergencies of the battle front and, most of all, the necessity of beating down Crossbow. If at any time you believe that we are uselessly neglecting opportunities for striking the German in his own country, do not hesitate to tell me about it."[50] Compromise and diplomacy at the strategic level was perhaps the most important reason Crossbow did not sink the Allied air effort, but operational reasons were also at play.

The second reason for Allied success was that Allied military leaders used an opportunistic targeting plan to maximize bombing results for both the main air effort and Crossbow. Before D-Day, but during Operation Crossbow, Commanding General of the US Army Air Forces, General Hap Arnold relayed his desired targeting priorities to Spaatz in a personal memorandum. He unequivocally relayed that Operation Pointblank was the top priority. Specifically, he wanted US air forces to achieve air superiority, then isolate the Overlord landing zone, and then provide 100% day and night support of the ground forces after D-Day.[51] With very few exceptions during the last two weeks of June, the CBO and the effort to support the Allied invasion were the priority, and Crossbow was less of a diversionary effort that conventional wisdom tends to portray.[52] Approximately 15% of Allied air sorties were flown against Crossbow targets. This percentage surged to 25% in some months. Of note, RAF contributions to Crossbow surged to 79% around the peak of Crossbow operations, from June to August of 1944. Also of note, the Crossbow reconnaissance effort stole 40% of the main effort's sorties.[53] These numbers are significant, yet 8th Air Force (8 AF) instituted an ingenious, albeit intuitive, method to optimize target selection. At this time radar-bombing methods were being pursued, but were too immature to ensure accurate targeting for 8 AF's high-altitude, precision-bombing methods. In other words, 8 AF preferred visual-bombing conditions. Eighth AF leaders opted to pursue Crossbow targets in mass raids when CBO

[50] As quoted in Probert, *Bomber Harris*, 296.
[51] Memorandum, General Henry "Hap" Arnold to General Carl Spaatz, 24 Apr 1944, Call # 519-161-7, IRIS # 00214811, AFHRA, Maxwell AFB AL.
[52] Hennessy, *Tactical Operations of 8th Air Force*, 167.
[53] *The "Crossbow" Campaign",* 27.

targets further inland were obscured by weather.[54] This tactic worked just enough to ensure civilian leaders in Britain were appeased.

Third, the Allied military air chiefs capitalized on opportunities. When the weather dictated a massive Crossbow effort, the Crossbow targets were often struck twice in one day due to their close proximity to England. Additionally, raids on Crossbow targets along the coast rarely elicited a Luftwaffe response, thus easing the added burden of diverting fighter escorts to the bombers. Lastly, the close proximity of the Crossbow targets allowed for more bombs to be carried per aircraft due to a lighter fuel requirement.[55] Capitalizing on the weapons' geographic limitations and striking only when opportune maximized Crossbow's effectiveness. In this manner, despite the high percentage of Crossbow sorties allocated overall, the operation's diversionary effect was minimalized.

Fourth, aiding in minimizing Crossbow's diversionary effect during the peak of its operations was the sheer quantity of aircraft the Allies possessed. June through August 1944 saw an estimated 6,700 V-1s launched towards England.[56] This was also a critical time for the Allies' Operation Overlord. However, in the last two weeks of June, Operation Crossbow was given priority over CBO operations. The sheer quantity of Allied aircraft absorbed the peak of simultaneous Crossbow and CBO requirements without derailing either effort.

Finally, US air chiefs used creative innovations that showed mixed results, but did succeed in showing a genuine level of effort to their British counterparts thus easing any potential exploitable rifts in the coalition. Hap Arnold approved innovations such as napalm bombs, glide bombs, and the adventurous War Weary Robot project, otherwise known as Operation Aphrodite. Aphrodite was an attempt to put precision effects onto the nearly impenetrable concrete domes located at the large V-2 sites. Aphrodite consisted of outfitting decommissioned B-17s with remote-controlled flying gear and a bomb bay full of explosives. The idea consisted of flying the B-17 by remote from an

[54] Hennessy, *Tactical Operations of 8th Air Force,* 176.
[55] Hennessy, *Tactical Operations of 8th Air Force,* 176.
[56] Kipphut, "Crossbow and Gulf War Counter-SCUD Efforts", 21.

adjacent "mother ship" into the V-2 sites.[57] The project was eventually scrapped, but did show a sincere effort to pay Crossbow targets their due. Aphrodite was yet another factor behind Allied military leaders' success in handling the diversion of air resources.

In sum, Hitler's V-weapons did not provide the decisive turning point in the war, nor did they blunt the Allied invasion to any degree. The weapons did affect the Allied strategic-air campaign significantly, but due to several reasons failed to create a large enough diversion of resources to achieve decisiveness. The next section will explore how the V-weapons were most and least effective.

What Worked; What Did Not

The purpose of this section is to explore the mechanisms at work during the V-weapon campaign in more depth to help construct the Dictator's Handbook in Chapter 3. It will cover several themes to draw insight on what aspects of V-weapon use was most and least effective. The themes involve V-weapon target selection, exploitation of their diversionary effect, and cost-effectiveness.

Of all of the V-weapons' targets, only one was truly effective at inciting a measurable response from the adversary. On the continent, V-weapons were directed against Antwerp, Paris, Liege, Tournai, Lille, Maastricht, Hasselt, and a bridge over the Rhine at Remagen (the last was the only true tactical target the Germans attempted to engage). In their effort hit the Remagen bridge, the Germans failed due to the inaccuracies of both the V-1 and V-2. The other towns did not receive enough fire, or were too small to have registered a substantial effect from the weapons. Only Antwerp received major physical damage. The intended effect at Antwerp was to harass and disrupt resupply for Allied forces. In targeting the military lines of communication the Germans found that, again, the targets were too small for the V-weapons to hit with any consistency. In the grand scheme, targeting Antwerp was a failure.[58]

German targeting had much better results in England. There the weapons were aimed at Bristol and London. These two cities were targeted because of their large civilian populations and industrial capacity. The effort against Bristol never gained

[57] Memorandum, General Carl Spaatz to General Henry "Hap" Arnold, 16 Jul 1944, Call # 519-1611, IRIS # 00214811, AFHRA, Maxwell AFB AL.
[58] *Report on Continental Crossbow*, 16.

footing as the launch locations on the Cherbourg peninsula were quickly overrun after D-Day. The attacks against London did not elicit the type of civilian uprising or annihilation Hitler desired, but did prompt a response in the form of Operation Crossbow due to the extreme anxiety they caused among British leaders.[59] Why was London targeted, and why did it appear to be the only target that stimulated an Allied response? Prussian military philosopher Carl von Clausewitz dedicated an entire, albeit short, chapter to the topic of diversions. In this chapter, he remarked that a successful diversion must hold at risk a target that the enemy assigns great importance. In fact, he mentions that for a diversion to work in the first place that "there must, of course, be an objective to attack."[60] In other words, a suitable target must present itself, and its character must hold substantial political or military value. Among the V-weapon's target sets, only London truly fit this description, because the V-weapons were only ever suitable to carry out a punishment attack against a political target. Their inherent inaccuracies ruled out the possibility of creating a diversion through denial attacks against small military targets. The weapons' inaccuracies, however, did not prevent them from instilling terror among civilians.

The level of terror that the V-weapons invoked was influenced by several factors. First, the lack of attack-warning struck great fear into populations. The fear of the unknown caused great anxiety in Churchill. After discovering the V-1 launch sites pointed at London, British leaders knew that an attack was imminent. The lack of warning stimulated the start to Operation Crossbow before the first V-weapon was fired. The initial waves of V-1 attacks struck greater fear than follow on attacks as public awareness grew of the characteristic V-1 "buzz bomb's" noise signature. But, their fears were once again stoked several months later by the undetectable approach and surprise impacts of the V-2.[61]

Second, in some scenarios inaccurate weapons can actually produce more terror than accurate weapons. Even after Londoners became aware of the threat they faced with the V-1s, they still had anxiety because they did not know where the missiles were going

[59] Davis, *Carl A. Spaatz and the Air War in Europe*, 426.
[60] Carl von Clausewitz, *On War*, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), 562.
[61] Dornberger, *V-2*, 95.

to impact. "The very fact that bombing was too inaccurate to serve military purposes made it primarily an instrument of 'terrorism': after all, random and unpredictable bombing enhanced terror."[62] Further, the absence of human control was credited with a particularly frightful effect on a population's morale.[63]

Third, the threat of biological or chemical-tipped warheads can up the fear ante, but should be used with caution. The fear of chemical attacks crossed Churchill's mind. In this author's judgement, Hitler did not fully pursue chemical or biological warheads for fear of retribution, and his experience being shelled with a gas artillery round in World War I. By the time the V-weapons were employed, the Allies had already started their continental invasion and were conducting air attacks deeper into Germany, to include German cities. Part of the reasoning behind using the V-weapons was retribution for city-bombing in German, so it would have been self-defeating to escalate the city wars in that manner. Since Hitler did not employ chemical or biological V-weapons, it is difficult make a definitive conclusion on their effectiveness. The nuclear, biological, and chemical threat will be discussed more in depth in the next chapter.

To summarize what was effective about V-weapons targeting: London was the most suitable target due to its political importance, and it was large enough to accommodate the inaccuracies of the weapons; the amount of terror the weapons generated increased the level of diversionary response; terror was increased through a lack of warning, using inaccurate weapons, and the implied threat of chemical or biological warhead use.

Hitler used both static and mobile V-weapon launch sites, and each yielded different diversionary impacts on the Allied air strategy. Both the V-1 and V-2 were eventually afforded "mobile" launch sites during the course of the war as a result of Crossbow. The mobile sites had advantages over the large static sites. They were more difficult to detect, which demanded an increased diversion of reconnaissance missions. They were more difficult to target due to their small size, which consequently demanded an increased diversion of more accurate low-altitude fighter-bomber attacks. Despite

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[62] As quoted in Michael S. Sherry, *The Rise of American Air Power: The Creation of Armageddon* (Yale: Yale University Publishing, 1987), 71.

[63] Memorandum, Colonel J.B. Gordon to Henry "Hap" Arnold, 14 Jul 1944, Call # 519-161-7, IRIS # 00214811, Study of the V-1, AFHRA, Maxwell AFB AL.

these advantages, Dornberger recorded that Hitler was in favor of rebuilding the large sites and even hardening them further against attack. Hitler remarked "these [the static] shelters must lure the enemy airmen like flies to a honeypot. Every bomb that drops on them will mean one less for Germany."[64] Due to the massive amounts of concrete used in static-site construction, especially for the V-2 sites, destruction required the largest bombs the Allies could muster. The only aircraft that could carry these bombs in sufficient quantity to afford "precision" targeting were the Allied heavy-bomber fleets. If the heavy-bomber fleets were diverted from the CBO, in particular the raids against German cities, then Hitler's V-weapons had accomplished something for the German people by merely presenting a threat.[65] On the other hand, if the large sites were under continual bombardment, the mobile sites were still required to achieve the counter-offensive Hitler sought.

The mobile sites afforded the Germans the ability to launch their V-weapons in the face of Crossbow attacks, but their use had unintended impacts. First, moving the V-2s from their static-launch positions made the already inaccurate weapons more inaccurate.[66] Surface-to-surface missile guidance requires knowledge of the launch point to know where to impact. It is the author's judgement that precise launch-site-location knowledge was adversely affected by moving the V-2s often to impromptu launch locations. Second, the fact that the sites, in particular the V-2 sites, were so difficult for the Allies to find and target that they led Allied air chiefs to seek new methods to minimize the diversionary effect. As discussed prior, the chiefs set out a compromise involving new Crossbow targets, such as V-weapons production and storage facilities, further inland. The inland Crossbow targets interdicted V-weapons in transit to their launch facilities, decreasing the number of launches.[67] The inland targets also helped draw the Luftwaffe into the air where they met the Allied fighter escorts. In sum, it is evident that both types of sites had their purpose. The static sites diverted the heavy bombers away from German cities, but the mobile sites were necessary to employ the V-

[64] Dornberger, *V-2*, 104.
[65] Dornberger, *V-2*, 103–4.
[66] *Report on Continental Crossbow*, 1.
[67] *Report on Continental Crossbow*, 8.

weapons. The type of missile-launch site used should best match the means to the desired military end. Unfortunately, this particular insight is probably most affected by the gains in technology over the years, specifically the employment of precision guided munitions that have rid the need for massive bomber fleets to take out fortified static targets. More analysis will take place on this subject in Chapter 2.

The final theme of this section involves the analysis of the cost effectiveness of Germany's V-weapons program to see if the results were worth the diversionary effort. Clausewitz stated in regards to diversions, "The main requirement is that the enemy should withdraw more men from the main scene of operations than are used for the diversion. If the numbers are even, the effectiveness of the diversion as such ceases, and the operation becomes merely a subordinate attack."[68] In this respect, we turn to the estimated costs of the V-weapons in both money and labor. The V-1 is estimated to have cost approximately 1/20th the amount of the V-2.[69] Unfortunately, it is difficult to place a dollar (or Reichsmark) amount on the weapons, especially the V-2, because the cost varied depending on the amount produced at the time. The first lots were much more expensive than later ones as production facilities came online during the war. Further, the V-2 never made it into mass production, thus even an accurate average, if produced, would be misleading. In terms of labor, the V-1 is estimated to have cost 300 man-hours, while the V-2 cost between 20,000 and 40,000 man hours. For comparison, one V-2 cost about six to seven fighter aircraft in man-hours.[70] Of note, these numbers do not account for the extensive research and development costs or the costs of dispersal to the sprawling underground complexes. To apply Clausewitz's maxim, it is next necessary to account for the cost to the Allies from the V-weapons.

The cost imposed on the Allies by the V-weapons was significant, but was outweighed by the German investment. Calculating the actual cost in money and labor of the Crossbow would likely involve a book-length study in itself. However, there are some observations that can help suggest conclusions about the matter. First, June through August of 1944 saw the peak of Crossbow activity. Second, this was a result of

[68] Clausewitz, *On War*, 562.
[69] Speer interview No. 11.
[70] O'Brien, *How the War Was Won*, 341.

the V-1 attacks against London. The V-2 was not launched until September of 1944.[71] Based on the Allied diversionary reaction that it provoked and its relatively low cost in money and labor, the V-1 was an economical diversionary weapon. The V-2 was not.

Summary

This chapter's aim was to analyze Adolf Hitler's use of his V-weapons during World War II. Hitler's had three strategic goals for his V-weapons. First, he meant to obtain a decisive effect on London and its decision makers. Second, he aimed to retaliate against the British night bombing of German cities. Third, he looked to bolster the morale of the German people with propaganda touting the use of his "miracle" weapons. Hitler chose his V-weapons to achieve these goals out of necessity. By 1943 he faced an asymmetric airpower disadvantage against the Allies. Other means of strategic attack were unsuitable or had failed him. Hitler thought the V-weapons proved a suitable technical fix to his strategic situation by 1943. As such, he used the weapons against the civilian population of London and against the Allied invasion force on the continent.

The V-weapons did not help win the war for Germany, but did force a positive unintended consequence. The weapons failed to achieve Hitler's desired objectives for several reasons. Hitler allocated adequate resources for the weapons too late and technical difficulties further delayed their employment. The Allies' actions ensured the V-weapons campaign did not succeed. The US and Britain, in particular, employed deft diplomacy and compromise, used opportunistic targeting, capitalized on the V-weapon's geographic limitations, brought enough aircraft to absorb the Operations Crossbow's diversionary shock, and used innovative means to further dissipate the diversionary effect. In the end, the employment of the V-1 and V-2 never achieved the mass effects required to coerce British politicians to secede from the war. However, the V-weapon campaign did succeed in significantly altering the Allied strategic air campaign by creating a politically required diversion.

Of the two primary target sets, London and Antwerp, the former was the most effective. Targeting Antwerp was a desperate attempt to stem one of many lines of communication to supply the Allied invasion forces. The V-weapons caused plenty of

[71] O'Brien, *How the War Was Won*, 347.

destruction, but were unable to stem the flow of supplies. Attacks on London, however, did succeed in stimulating a political reaction by sowing terror among the population.

The chapter explored three themes concerning the effectiveness of Hitler's V-weapon use. The first theme involved aspects of the V-weapons campaign that amplified the terror that helped spur a political reaction. The lack of warning of attack was a primary source of terror. Whereas the V-1's noisy motor warned Londoners of an impending impact, the V-2 produced no such warning, and as a result was more feared. The inherent inaccuracies of the V-weapons also stoked terror in the civilian populace. The fear that an autonomous weapon could land anywhere at any time provided a sense of unpredictability that terrorized Londoners. Also, the fear of chemical gas attacks delivered by the V-weapons placed an ever-present fear in the minds of London civilians and politicians.

The second theme included a look into the possible exploitation of the diversionary effect of the V-weapons against the Allies. Hitler used both fixed and mobile launch sites for his V-weapons. Both sites held advantages. Continual repairs of the fixed sites forced the Allies to divert fleets of heavy bombers away from German cities. However, their constant suppression meant that mobile sites became a necessity to actually employ the V-weapons. The mobile sites complicated Allied efforts to detect launch locations, thus amplified and extended the diversionary effect.

The final theme contained an analysis of the cost effectiveness of the V-1 and V-2. The cost of the V-2 monetarily and in labor vastly outweighed that of the V-1. The V-1 was employed first and caused the largest reaction from the Allies. The V-2 possessed advantages in technology and was indefensible while the V-1 was not. But, the V-1 imposed a greater cost on the Allies while the V-2 imposed a greater cost to Germany. In sum, the V-1 was cost effective, and the V-2 was not.

Chapter 2

Desert Storm's "Great Scud Chase"

Iraqi dictator Saddam Hussein's Scud missile campaign during Operation Desert Storm provides another, more recent case study in which surface-to-surface missile (SSM) use significantly affected the opponent's strategic air campaign. This chapter aims to apply the same analytical framework from the Crossbow case study to the US-led coalition's anti-Scud effort during Desert Storm, unofficially dubbed the Great Scud Chase. The chapter will address Saddam's desired objectives for his Scud forces during the conflict. Next it will analyze why actual results differed from his desired results. Finally, the chapter will conclude by exploring the most and least effective aspects of Hussein's Scud campaign.

Hussein had a history with surface-to-surface ballistic missiles prior to Desert Storm. Iraq may have added ballistic missiles to its arsenal as early as the 1960s during the bubbling tensions of the Arab-Israeli disputes. No later than the 1970s Iraq had positively acquired FROG 7 missiles, again because of the continuing tension with Israel. By the 1980s, Iraq's obsession with ballistic missiles was reaching its apex as Hussein sought to purchase more advanced missiles abroad while simultaneously starting his home-grown attempts at missile production.[1]

How Saddam incorporated his SSMs into his grand strategy evolved throughout the years as his strategic environment changed. For example, Saddam used his missiles during the Iran-Iraq War to pursue a punishment coercion strategy. During the war Iraq and Iran exchanged almost 1,000 ballistic missiles.[2] This exchange culminated in the War of the Cities between the two antagonists whereby both governments sought to terrorize each other's civilians with constant SSM attacks until their adversary capitulated.[3] This was not the only time Saddam sought to wage a punishment-style air campaign to coerce his enemies.

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[1] Navias Martin S, *Going Ballistic: The Build-up of Missiles in the Middle East*, 1st English ed (London; New York: Brassey's, 1993), 196.
[2] Navias Martin S, *Going Ballistic*, 127.
[3] Navias Martin S, *Going Ballistic*, 136.

During Desert Storm, Hussein had several intended strategic objectives for his Scud force. Saddam faced two regional adversaries: Arab states aligned with the US and his old enemy, Israel. By targeting Saudi Arabia and Bahrain, he intended to destabilize what he viewed as hostile Arab governments who had thrown their support behind the US-led coalition. He desired "'the Arab masses and all Muslims' to revolt against the 'oil amirs [sic]'" who had in his view broken ranks.[4] Hussein had several strategic reasons for targeting Israel. He hoped to draw them into the war thus upsetting the US-Arab coalition; to gain prestige among his Arab peers by standing up to their historic enemy; and to inflict revenge against those who had destroyed his Osirak nuclear reactor in 1981.[5] Ultimately Hussein' Scud campaign failed to achieve any of his strategic objectives. Arab civilians did not revolt in mass and Israel remained sidelined. To begin the analysis as to why his missile strategy failed, it is next necessary to explore why Hussein thought his missile forces would achieve his desired strategic goals in Desert Storm. The following section will assess Scud employment results and determine what they actually achieved for Saddam.

What Hussein's Scud Weapons Were Meant to Accomplish

Just as Hitler hoped for great things from his V-weapons, Hussein thought his Scud missiles would provide a much-needed offensive means to achieve strategic ends. His chief strategic end was to break the US-led coalition by having Arab countries withdraw their support for the coalition, and have Israel take unilateral action against Iraq. US President George H. W. Bush recognized the danger of unilateral Israeli action, which he thought may result in a war between Jordan and Israel.[6] The intriguing question here is: why did Hussein come to rely so heavily on his Scud weapon system to achieve such ends?

Unlike Hitler, Hussein was not necessarily forced to rely on his missiles to achieve offensive strikes, at least initially. Iraq possessed seemingly formidable air and ground forces. Regarding his ground forces, the Gulf War Air Power Survey remarked

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[4] As quoted in U.S. Department of the Air Force, *Planning,* Gulf War Air Power Survey (GWAPS), Volume I, Part I (Washington DC: United States Government Printing Office, 1993), 63.
[5] Navias Martin S, *Going Ballistic*, 151.
[6] U.S. Department of Defense, *Conduct of the Persian Gulf War: Final Report to Congress,* 1 Apr 1992, Call # K160.04-12, IRIS # 00888272, part of the Desert Shield/Desert Storm documents, AFHRA, Maxwell AFB AL, 223.

"Saddam believed that Iraq's experience in its war with Iran and his own reading of history, proved that ground forces comprised the branch of decision in warfare."[7] Successful Operations Desert Shield and Desert Storm prevented Hussein's ground forces, the 4th largest army in 1990, from providing the means necessary to fracture the US-led coalition.[8]

Hussein's air force also failed to provide the means necessary to shatter the coalition. The reasons behind the collapse of the IQAF during Desert Storm provide insight as to why Hussein favored his missile forces for decisive effects. The IQAF, the sixth largest air force in the world in 1990, was ultimately routed during Desert Storm, leaving Iraq at a significant asymmetric airpower disadvantage. Desert Storm started on the morning of 17 January 1991. By 25 January the IQAF stood down, and the next day its remaining aircraft fled to Iran. Approximately 120 aircraft fled, but only after coalition air forces destroyed more than 200 on the ground and 35 in the air.[9] Several factors explain the IQAF's failure in Desert Storm, and why Hussein grew to prioritize his missile forces over his air forces even prior to Desert Storm. These factors include Saddam's procurement sources, lessons learned during the Iran-Iraq War, and geographical influences.

First, unlike Germany in World War II, the IQAF was not hindered by the lack of a specific offensive air platform. The IQAF was comprised of modern equipment including fighter-bomber and heavy bomber platforms. Iraq did not possess an indigenous aircraft industry. Instead it purchased its wares from foreign suppliers with its ample oil money, and it found willing sellers in Russia and France. In the midst of the 1980s Cold War, Russia viewed the Middle East as a vital area of concern and desired influence. Accordingly, Russia eagerly supplied arms to Third World countries in the Middle East, such as Iraq, to push them towards the Russian sphere of influence.[10] France, who found herself susceptible to Arab oil embargoes, also willingly sold

[7] GWAPS, Volume I, Part I, 64.
[8] U.S. Department of the Air Force, *Reaching Globally, Reaching Powerfully: The USAF in the Gulf War*, 1 Sep 1991, Call # K239.0472-37, IRIS # 00876193, part of the collection of material assembled by C.A.D.R.E., AFHRA, Maxwell AFB AL, 4.
[9] *The USAF in the Gulf War*, 33.
[10] Navias Martin S, *Going Ballistic*, 64.

advanced weaponry to unsavory Middle East states.[11] The Iraqi IADS, for example, was of French design. There are several downsides to purchasing arms, especially complex air assets, from a foreign party. First, one's continued supply of equipment, such as munitions and parts, is often tied to an assumption of continued political amicability between both parties. Second, without experiencing the growing pains of learning how to produce, train, and equip your own forces, performance can suffer when put to the test of combat. These vulnerabilities help explain why Iraq's Scud force eventually displaced the IQAF, but are not the only reasons.

Second, and most important in Hussein's assessment of his air forces, were the lessons he derived from his war against Iran. Hussein's air strategy during that war involved punishment-style terror attacks against civilian population centers. Unable to consistently attack small tactical targets, to include adversary missile launchers, the IQAF was generally used to conduct strategic strikes against cities. Increasingly, however, manned aircraft became more of an auxiliary to the missile forces in this role for several reasons. First, the IQAF's general combat effectiveness and overall command and control was poor.[12] Second, as the war progressed, Hussein's missile arsenal rapidly improved. He started with short range FROG 7s missiles. But attacking targets beyond the FROG's range still required IQAF deep penetration capabilities. By the War of the Cities in 1988, Hussein was in possession of the longer range Scud missile which was able to target Tehran, thereby reducing his reliance on the IQAF. Third, there was no defense against ballistic missiles as there was against fighter or bomber aircraft. By the end of the Iran-Iraq War, Hussein preferred to employ his missiles for offensive strikes, thereby relieving his aircraft and pilots from these complex and dangerous missions.[13] This logic likely explains why Hussein opted for missiles over aircraft for offensive strikes during Desert Storm and why he sent his aircraft to Iran only 10 days into the war. Additionally, by the end of the War of the Cities, war-weary Iran, depleted from 8 years of hostilities, eventually sued for peace. Hussein's lesson from the war was that his

[11] Maj Douglas A. Kupersmith, "The Failure of Third World Airpower: Iraq and the War with Iran" (School of Advanced Airpower Studies, Air University, 1992), 29-31.
[12] Navias Martin S, *Going Ballistic*, 143.
[13] GWAPS, Volume I, Part I, 206.

missiles, not his air force, had proved decisive.[14] Hussein had fallen prey to air power's recurring and seductive promise of securing decisive victory cheaply and quickly. For Iraq that air power was derived from a growing missile force at the expense of an effective air force.

The final reason that Iraq continued to favor its missile force over the IQAF deals directly with its geographical context. On one hand, Hussein viewed his missile fleet as a type of soft power. He regarded the missiles as a status symbol, a token of Iraq's technical prowess and prestige that he often paraded down the streets of Baghdad. On the other hand, regional-security concerns tempted Hussein to increase his arsenal in accordance with a classic security dilemma. After the Iran-Iraq War, Iran sought to counter Iraq's growing missile force by increasing its own missile forces. This action provoked Iraq to buy more missiles to retain its advantage. The resulting acquisitions on both sides led to a missile race between the two countries.[15] Iraq's regional security dilemma also extended to other countries, notably Israel.

By deploying Scud launch sites in western Iraq before Desert Storm, Hussein meant to deter Israeli offensive action, such as what occurred against Iraqi's Osirak nuclear reactor site in 1981. Iraq's ground efforts against Israel in 1948, 1967, and 1973 left much to be desired, thus Saddam viewed his seemingly formidable army as a weak deterrent against Israel. Other methods of conventional deterrence involved air power. The IQAF proved no match for the Israeli Air Force, but there were other options available. In addition to reinforcing his integrated-air-defense system to deter Israeli air strikes, Saddam meant to hold Israeli population centers at risk of retribution via Scud attack. The characteristics of ballistic missiles provide a convenient gap-filler for the lack of an effective manned air force. Generally missiles are cheaper to acquire and maintain. The proficiency required for their employment is generally less than that demanded to sustain a cadre of pilots and maintainers. Most importantly for Iraq, ballistic missiles almost guaranteed the deep, near-indefensible penetration required to strike Israeli targets. In a situation reminiscent of Hitler's missile campaign, Iraq could

[14] Navias Martin S, *Going Ballistic*, 136.
[15] Navias Martin S, *Going Ballistic*, 47–48.

counter Israel's asymmetric airpower advantage through the use of ballistic missiles.[16] Thus, by purposely constructing Scud launch sites within striking range of Israel's major population centers, Saddam meant to deter Israeli offensive action; his IQAF was deemed unsuitable for this task and consequentially received less attention.

Intelligence estimates vary, but on the eve of Desert Storm Hussein had acquired a fleet of approximately 400 missiles.[17] The missiles' purpose was two-fold. First, they were meant to deter Iraq's enemies, such as Israel and Iran, by threatening vital targets within each country's borders. Second, they were intended to retain an offensive-strike capability in the face of overwhelming air power that rendered the IQAF useless. In the event of their use, the preponderance of strikes were aimed at the hearts of population centers in an effort to provoke terror. In Hussein's eyes, sufficient terror should create enough civilian pressure on the political leaders of his enemies to relent to Iraq's will. Like Germany, Iraq found that its missile use did not achieve the desired objectives against its enemies, but their use did significantly influence the coalition's strategic air campaign. That influence is the subject of the next section.

What Hussein's Scud Weapons Actually Accomplished

Iraq's use of Scud weapons did not help it achieve the desired strategic goal of fracturing the US-led coalition. The context surrounding Saddam's Scud campaign is remarkably similar to those of Hitler's V-weapon campaign. First, Saddam found himself at a severe airpower disadvantage against the US-led coalition. His Scuds, however, offered a means of offensive strike. Second, his missiles did not achieve his desired objectives, but did manage to cause a significant diversion and disruption to the coalition's strategic air campaign. The diversion occurred because Iraq targeted politically sensitive targets—Israeli and Saudi population centers. Despite the significance of the diversion, the coalition overcame the difficulties the diversion imposed on their air campaign. The following three factors contributed to that success: Iraq's patron ceased its support; Hussein overestimated the fragility of the coalition, and he underestimated the restraint shown by Israel. An in-depth look at these reasons will

[16] Kupersmith, "The Failure of Third World Airpower: Iraq and the War with Iran," 47.
[17] GWAPS, Volume I, Part I, 211.

follow a brief account of how the coalition responded to the use of Scuds and the results of the Scud campaign.

The coalition's anti-Scud effort evolved throughout the war. Checkmate director Colonel John Warden acknowledged the important relationship of tying US political objectives to military objectives when authoring the initial strategic air campaign plan, Instant Thunder. His plan targeted Iraqi strategic offensive capabilities and military production and storage facilities in an effort to satisfy President Bush's emphasis on reducing threats to friendly nations.[18] However, two issues prevented Instant Thunder from blunting the Scud threat earlier in the war. First, Instant Thunder became diluted as the strategic air campaign plan evolved leading up to war. Instant Thunder's target set grew. For example, Secretary of Defense Dick Cheney and Chairman of the Joint Chiefs of Staff General Colin Powell added Iraqi Republican Guard targets.[19] Additionally, Instant Thunder was demoted to phase one of a four-phased air campaign with more emphasis added on attriting Iraqi Army units.[20] Second, intelligence reports failed to account for dispersal of most of Iraq's Scud transporter-erector launchers (TELs) from their peacetime storage sites months prior to Desert Storm.[21] The resulting air plan to counter the Scud threat during the opening days of war consisted primarily of attacks against fixed Scud-launch sites, production facilities, and storage warehouses.[22] This effort missed most, if not all of Iraq's TELs and left more than enough missiles intact to conduct the Scud campaign.

After Hussein made good on his promises to launch his missiles against Israel shortly after the war began, coalition air chiefs were placed under considerable political pressure to increase their anti-Scud effort. Coalition endeavors at this point consisted of several elements. Their airborne sensors attempted pre-launch identification and destruction by detecting typical pre-launch signatures noted during Soviet Scud operations in Europe. However, the Iraqis opted to avoid pre-launch emissions. The

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[18] John Andreas Olsen, *Strategic Air Power in Desert Storm*, Cass Series--Studies in Air Power 12 (London ; Portland, OR: Frank Cass, 2003), 105.
[19] Olsen, *Strategic Air Power in Desert Storm*, 131.
[20] Olsen, *Strategic Air Power in Desert Storm*, 110.
[21] John Andreas Olsen, "Operation Desert Storm, 1991," in *A History of Air Warfare*, 1st ed, ed. John Andreas Olsen, (Washington, D.C: Potomac Books, 2010), 190 and GWAPS, Volume I, Part I, 69.
[22] U.S. Department of the Air Force, *Summary Report*, GWAPS (Washington DC: United States Government Printing Office, 1993), 43.

coalition attempted search-and-destroy operations via airborne Scud patrols. The patrol's job was to locate TELs post-Scud launch. This effort was largely thwarted by aircraft-sensor limitations and the small, mobile nature of the TELs executing shoot-and-scoot tactics. Other efforts included air attacks with bombs and mines meant to deny TEL hiding sites, travel routes, and known mobile launch areas. Special operators were tasked to help locate TELs for aircraft.[23] The US provided Patriot missile batteries in both Saudi Arabia and Israel. The Great Scud Chase was estimated to have consumed 1,500 sorties, most occurring in the first three weeks of the war.[24] Similar to Crossbow, the reconnaissance and intelligence effort to locate mobile launchers was "considerable" and relied extensively on low-density assets such as the E-8 Joint Surveillance Target Attack Radar System and the P-3 Orion.[25] Overall, the coalition conducted approximately 1,500 Scud-related strikes. About half of those strikes were against potential hiding places, 30% against production and storage, and only 215 strikes (15%) were against reported TELs.[26]

The coalition's anti-scud effort was a strategic success, but its tactical effectiveness was questionable. Ultimately the effort worked well enough to prevent Saudi withdrawal from the coalition or unilateral Israeli action. However, operational and tactical issues threatened to derail the strategic success on several fronts. First, pre-war planning made an incorrect assumption that attacking Scud fixed sites along with production and storage facilities would negate the Scud threat sufficiently.[27] This assumption was never readdressed by US military leaders. In fact, with the exception of Warden's Checkmate, they consistently undervalued the political significance of the Scud threat in light of its low threat to their military forces.[28] This troubling tendency will be addressed further in Chapter 3. The ad hoc reaction of providing Scud patrols and attacking TELs post-launch was a direct result of this issue. The actual effects of such attacks and patrols have never been satisfactorily determined. The evidence suggests that few, if any, TELs were likely destroyed. Prewar intelligence assessments credited the

[23] *Summary Report,* GWAPS, 83-88.
[24] *Summary Report,* GWAPS, 84.
[25] *Conduct of the Persian Gulf War, 225.*
[26] *Summary Report,* GWAPS, 84.
[27] GWAPS, Volume I, Part I, 119.
[28] GWAPS, Volume I, Part I, 104.

Iraqis with between 22 and 37 TELs. Aircrew reported about 80 TELs destroyed. The number of TELs found after the war was 19. The disparity between reported and actual TELs destroyed is probably due to two reasons. First, the Iraqi's use of high fidelity TEL decoys likely fooled some aircrew. Second, the number of destroyed oil tankers in the vicinity of targeted TELs suggests that they were often mistaken for TELs.[29] On the defensive side, Patriot intercept success rates are also highly disputed. After publishing overly optimistic success rates, the US Army eventually claimed intercept success rates at 70% and 40% over Saudi Arabia and Israel respectively.[30] Finally, the fact remains that the coalition was never able to eliminate Scud launches altogether, and the number of launches actually increased in the latter weeks of the war.[31]

Coalition tactical effectiveness was not all bad news. The average Scud launches per day changed from 4.7 during the first week to 1.5 during the remainder of the operation.[32] As previously noted, Scud launches did pick up the pace towards the end. This suggests several conclusions. First, the lull in launches after the first week, the number of reports of destroyed TELs, and perceived Patriot success suggested to military planners that their effort to find and destroy the mobile Scud threat had largely been effective.[33] The drop in launches was likely due to a combination of factors. On one hand, camouflage and concealment efforts to hide TELs from the coalition's reconnaissance sorties added time between launches.[34] On the other hand, the majority of Iraq's missiles were stored in the East in case future conflict with Iran. The coalition's air campaign made transportation to within launch ranges in the west difficult. The increased transportation time also helped cause the decrease in Scud launches.[35] The end-of-war spike in Scud launches was likely an act of desperation from Hussein as coalition ground forces quickly moved towards Baghdad. It is reasonable to assume that

[29] GWAPS, Volume I, Part I, 211 and *Summary Report*, GWAPS, 87 and 89.
[30] U.S. Department of the Air Force, *Effects and Effectiveness*, GWAPS, Volume II, Part II (Washington DC: United States Government Printing Office, 1993), 118.
[31] *Summary Report*, GWAPS, 88.
[32] *Summary Report*, GWAPS, 87.
[33] *Summary Report*, GWAPS, 89.
[34] Olsen, *Strategic Air Power in Desert Storm*, 261.
[35] U.S. Department of the Air Force, *Operations*, GWAPS, Volume II, Part I (Washington DC: United States Government Printing Office, 1993), 183 and 186.

he ordered his missile forces to launch as many Scuds as possible before they were captured by coalition ground forces.

Despite the many shortfalls, Saddam's Scud campaign did achieve some results. The campaign killed and injured relatively few people, but left a significant level of property damage while generating an immeasurable level of psychological terror. The Iraqis fired an estimated 88 Scuds during the course of the war (reference Table 2 for details concerning the number of killed and injured by Scud attacks). Iraq fired Scuds against the Israeli population centers of Tel Aviv and Haifa hours after the coalition started its air campaign. The Final Report to Congress concerning the conduct of the Gulf War remarked that the "political and emotional impact was tremendous."[36] Hussein had threatened retaliatory strikes against Israeli cities if attacked. These threats were deemed credible enough to issue Israeli citizens gas masks. Israelis have always lived under an umbrella of continual threats. However, even they were shocked to have been attacked by a country with which they were not at war in what was regarded as a safe rear area.[37] Hussein assumed his terror campaign by air would achieve the same results that he achieved against Iran only a few years earlier. The Israeli civilians successfully adapted to the threat, turning the Scuds into merely a "weapon of disruption" versus a weapon of terror.[38] Iraq was not able to inflict the amount of mass attacks and resultant casualty counts necessary to instigate an Israeli uprising.[39] This reason begs the question as to why Iraq was not able to achieve the necessary mass and concentration with its Scud campaign.

Table 2: Scud-related deaths and injuries during Desert Storm

	Israel	Saudi Arabia
Launched	39	37
Killed	13	1*
Wounded	268	77
*not including the US barracks attack at Dhahran		

[36] *Conduct of the Persian Gulf War*, 224.
[37] Navias Martin S, *Going Ballistic*, 1–2.
[38] Navias Martin S, *Going Ballistic*, 154.
[39] Navias Martin S, *Going Ballistic*, 171.

Note: the remainder of the 88 launches were not matched to specific impact points

Source: Adapted from the Robert A. Pape, Bombing to Win: Air Power and Coercion in War (Ithaca, NY: Cornell University Press, 1996), 357–58; Eliot Marshall, "Patriot's Scud Busting Record Is Challenged," Science, May 3, 1991, 640.

There are several reasons why Iraq's Scud campaign failed. The first is that it lost its arms benefactor, the USSR. The loss of his weapon supplier was a significant cause behind Hussein's inability to attack with Scuds in mass. Iraq was a prized customer of the USSR, especially during the Iran-Iraq War that raged from 1980-1988. However, even an arms dealer as lax as Russia would not heedlessly sell unrestricted amounts of ballistic missiles. While the USSR supplied missiles to non-signatories of the Non Proliferation Treaty, even it showed restraint by limiting the supply of more-advanced missile designs to Iraq in the 1980s. Further, the Soviets refused to support Iraq during Desert Storm. This was likely due to the USSR's growing retrenchment policies and willingness to deal with the US, both symptoms heralding its eventual collapse later in 1991. There is also a possibility that the USSR recognized its own vulnerability to ballistic missiles, and subsequently limited its missile sales further.[40] As for Iraq's limited indigenous Scud-production capability, it was dispersed as early as August of 1990 as the threat of coalition invasion grew. During the war, Scud production facilities were among the first to be targeted and were kept under continual pressure.[41] The end result was an Iraq with limited quantities of less-advanced missiles at the start of Desert Storm, and no means of acquiring more during the war.

A second factor contributing to Iraq's failed Scud campaign was Hussein's overestimation of the coalition's fragility, evidence of which takes several shapes. First, targeting Saudi Arabia and Bahrain did not achieve much for Iraq strategically. By targeting both Arab countries, Saddam intended to coerce them to withdraw from the coalition, or at least withhold their support. The Scud campaign failed to inflict enough damage to incite the planned Arab revolt. The campaign lacked enough concentrated fire. Also, being Arab monarchies, both target states probably lacked the required

[40] Navias Martin S, *Going Ballistic*, 68–69.
[41] GWAPS, Volume I, Part I, 69.

political levers by which the populace could exert influence on their governments. Retribution for the Scud attacks was almost certainly best executed by Saudi Arabia and Bahrain's continued inclusion in the US-led coalition, not by withdrawing their support. Lastly, the US viewed Saudi Arabia's oil supply as a vital security interest. In other words, the American were guaranteed to support the Saudis in the face of an Iraqi attack. US President Bush made this clear to Riyadh, ultimately comforting the Saudi king enough to avoid a withdrawal of support.[42]

Second, the US proved more resilient in the face of predicted mass US casualties than Saddam anticipated. Saddam is on record as saying that he was "sure that if President Bush pushes things toward war…once 5,000 of his troops die, he will not be able to continue war."[43] Hussein also drew erroneous conclusions from the rapid US withdrawal of forces from Lebanon after the 1983 Marine barracks bombing.[44] To be sure, the US was casualty-averse in 1991, still dealing with the lingering memories of its Vietnam experience. But the fact remains that President Bush pressed forward in the face of dire predictions of mass US casualties, and in the end, US leadership was vital to the coalition. It should be noted that the coalition completed the war so quickly that President Bush never had to face the consequences of mass US casualties. The quick pace of the war also allowed minimum time for Saddam's attempts to fracture the coalition.

Third, both the US and Israel expected attacks against Israeli population centers, and there was a plan in place to mitigate the damage. It is true the Israeli civilians were shocked that Saddam actually carried through on his threats, but the civilian and military leaders of both countries had at least thought about how to deal with that eventuality. In Israel, the government had distributed gas masks and enacted civil-defense procedures.[45] For the US, the air campaign placed high emphasis on eliminating nuclear, biological, chemical, and Scud-related facilities on the first night of strikes. In fact, after Saddam's threats against Israel, the strategic air campaign increased the servicing of Scud-related

[42] *The USAF in the Gulf War*, 6-7.
[43] As quoted in GWAPS, Volume I, Part I, 64.
[44] GWAPS, Volume I, Part I, 64.
[45] Navias Martin S, *Going Ballistic*, 1.

targets by 404%. Some of this increase involved creating several targets from a single site, but it still shows the emphasis placed on eliminating the Scud threat.[46]

Fourth, Saddam's Scud campaign could have threatened the entire coalition air campaign, perhaps unintentionally, by diverting significant assets away from the main effort. While the Great Scud Chase consumed a considerable amount of resources, it was not as much of a diversion as conventional wisdom suggests for two reasons. First, the anti-Scud campaign involved approximately 1,500 strike sorties. The number of strikes was only 3% of the war's 42,000 total. The number of Scud sorties was only 1% of the war's estimated 118,661 sorties.[47] Similar to Crossbow, the coalition simply had sufficient air power assets on hand to absorb the additional burden the anti-Scud effort added to the main effort.[48] Second, the initial reported number of strike sorties for the anti-Scud campaign was 2,500 versus the official Gulf War Airpower Survey's report of 1,500. The extra 1,000 sorties were launched on anti-Scud sorties, but ended up dropping on back-up targets after failing to locate the reported TELs.[49] Even including the 1,000 additional strike sorties, the Scud campaign would have comprised only 2% of the coalition's sorties. Similar to Crossbow, albeit less severe, the coalition's use of opportunistic targeting and sheer amount of aircraft minimized the diversion during the Great Scud Chase.

Fifth, President Bush grasped the true political gravity of the Scud threat to Israel and enacted unprecedented actions to reduce the strategic implications. Bush acknowledged the unquestioned right of Israel to defend itself. He also recognized that an Israeli response could involve unconventional weapons. In an effort to avoid any unilateral Israeli action, Bush directed a secure communications network linking the US Department of Defense and the Israeli Ministry of Defense. This link, plus the four US Patriot batteries, and accelerated deliveries of Israeli-manned Patriot batteries, allowed for an advance warning of approximately 5 minutes for Israel-bound Scuds. Additionally, Bush authorized creation of a planning cell in the US embassy in Tel Aviv where Israeli intelligence specialists could assist with the coalition's counter-Scud

[46] GWAPS, Volume I, Part I, 212.
[47] *Summary Report*, GWAPS, 184-185.
[48] GWAPS, Volume II, Part II, 119.
[49] *Summary Report*, GWAPS, 84.

campaign. The Israelis were allowed to monitor counter-Scud mission numbers and voice any concerns to D.C., who in turn, pressured coalition air chiefs as required.[50] The bottom line is that deft diplomatic wrangling by the Bush administration allowed an outlet for Israeli pressure, preventing unilateral Israeli action.

The last overarching factor that defeated the Iraqi Scud campaign was Hussein's underestimation of Israeli restraint. The root cause for this forbearance is unclear. It may have boiled down to luck. What is certain is that through a combination of elements, the Israelis did not enter the war. Good diplomacy, perceived and actual effectiveness of the Patriot systems, the ad hoc Scud patrols, the lack of concentrated effects from the Scud strikes, the quick pace of the war, and the enormous US ground presence massing for attack in Saudi Arabia all played their parts in alleviating Israeli concerns. All that is certain is the result; Israel chose to forego unilateral action thus denying Saddam one of his strategic objectives.

In sum, Hussein's Scuds did not achieve what they were sent out to do. They influenced the coalition's strategic air campaign, but the loss of Iraq's Russian benefactor, Hussein's overestimation of the coalition's fragility, and his underestimation of Israel's restraint prevented coalition strategic failure. As in World War II, the missiles did create a significant diversion, but skilled diplomacy, large quantities of aircraft, and opportunistic targeting helped blunt the worst of the diversionary effect. The next section will explore what aspects of the Scud campaign were most and least effective.

What worked; What Did Not

A further exploration of the mechanism at work during Hussein's Scud campaign will help build the Dictator's Handbook in Chapter 3. The themes involved include target selection, exploitation of the missile's diversionary effect, and the Scud's cost effectiveness.

First, Hussein targeted Israel, Saudi Arabia, and Bahrain. Ultimately his target selection provoked a coalition response. Arguably it was the attack upon Israel that energized the coalition's ad hoc anti-Scud campaign. Bahrain did not sustain much, if any, damage from Scuds. It was targeted for only one day with three missiles, and at

[50] *Conduct of the Persian Gulf War,* 223.

least one of those missiles was intercepted by a Patriot missile.[51] Saudi targets included Riyadh, Dhahran, Hafr al Batin, and King Khalid Military City.

Saddam clearly sought to wage a punishment operation against Saudi population centers. However, it is unclear if he also sought a simultaneous denial strategy against the few military targets co-located with large population centers, such as in Dhahran and King Khalid Military City. The latter was only targeted in the later parts of the war, so they may have been targeted out of necessity. As the coalition ground forces pushed the Iraqi forces towards Baghdad, Scud launches occurred from closer to Baghdad. The resultant increased firing range explains why Saddam's target shifted from population centers like Riyadh to targets closer to Baghdad, such as, Dhahran and King Khalid Military City.[52] The increased firing range and potentially the lack of pre-surveyed launch sites accounted for the observed decrease in accuracy in the Scuds towards the end of the war.[53] It is entirely possible that perceived Scud attacks against Bahrain and any military targets were simply misses. Adding further doubt to an intentional denial strategy by Saddam is the report that the Scud that did actually hit a military target had broken up in flight. The breakup prevented a successful Patriot intercept and gave the warhead an unpredictable flight path.[54] In other words, the Scud that did impact a US Army barracks in Saudi, killing 27 and injuring 98 soldiers was likely a lucky shot.[55] Finally, Saddam missed lucrative targets such as disembarking troops and equipment at Saudi ports at the beginning of the war.[56] While impossible to rule out, it appears unlikely that Saddam specifically sought to execute a denial strategy with his Scud campaign. He clearly accepted any fortunate results that he may have attained by attacking population centers with co-located military targets. Also clear, is that any attempt at pursuing a denial strategy failed to blunt coalition military forces to any appreciable degree.

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[51] R. W. Apple Jr., "War in the Gulf: Scud Attack; Scud Missile Hits a U.S. Barracks, Killing 27," *New York Times*, February 26, 1991 and *Summary Report,* GWAPS, 83.
[52] GWAPS, Volume II, Part I, 183.
[53] Navias Martin S, *Going Ballistic*, 153.
[54] Apple Jr., "War in the Gulf: Scud Attack; Scud Missile Hits a U.S. Barracks, Killing 27."
[55] *The USAF in the Gulf War,* 27.
[56] *Conduct of the Persian Gulf War,* 226.

Hussein generally favored a terror campaign against civilians with his missiles, drawing on the lessons of the Iran-Iraq War, and the fact that the Scud's inaccuracy favored large, city-sized targets. In the Iran-Iraq War, Saddam had witnessed his Scuds create panic, mass evacuations, and civil revolt that influenced Iranian political leaders to sue for peace.[57] Against Iran he used about four times as many missiles as in Desert Storm and achieved much greater carnage. Iraq fired approximately 361 missiles and killed an estimated 3,000 Iranians while wounding 11,500.[58] Saudi geography, demography, and political context provided a different type of target than Iran. The Saudi targets were less densely packed, the population less informed, and they likely lacked the necessary political levers to successfully influence their government. In contrast, Israeli public influence was a very real concern if its civilian centers were subjected to Tehran-like carnage. Israel's coastal cities were significantly more packed and its government more responsive to its constituents' concerns.[59] This contrast highlights the potentially greater value in targeting a state that is receptive to the political expressions of its citizens.

The amount of terror the Scuds generated was a function of a lack of warning, inaccuracy, and the threat of chemical or biologically-tipped warheads. The initial lack of warning after the first few salvos of Scuds hit Tel Aviv and Haifa instigated the most shock and terror among Israeli civilians. However, once the provisions President Bush enacted were in place, specifically the early warning system, the feelings of terror generally gave way to those of annoyance. The Scuds still killed innocent civilians, injured scores more, and destroyed thousands of apartments, but the initial terror generated by the attacks more-or-less subsided as a result of reasonable warning.[60]

Inaccuracy was compounded by shoddy construction of the Scud surface-to-surface missile, and this increased the terror level. The Scuds were notoriously inaccurate which often resulted in their use against large population centers. Lesser known was their shoddy workmanship. The Scuds would often break apart upon reentry. This presented the Patriot missile defense system with several issues. To start, it had to

[57] Kupersmith, "The Failure of Third World Airpower: Iraq and the War with Iran," 37.
[58] Navias Martin S, *Going Ballistic*, 133–36.
[59] Navias Martin S, *Going Ballistic*, 155.
[60] Navias Martin S, *Going Ballistic*, 154.

target the piece containing the warhead to achieve a successful intercept. If the Scuds broke apart, the smaller pieces were difficult to detect, and even harder to hit because they maneuvered unpredictably. Finally, even if the Patriot successfully destroyed the warhead, the other pieces generally impacted parts of the city causing destruction sans warhead.[61] Shoddy missile construction can inadvertently complicate the best active defenses, thus undermining the positive psychological effect of the defensive measures.

The threat of nuclear, biological, or chemical (NBC) equipped warheads was a real, and terrifying threat to Israelis. Besides the overt threat of unconventional missile attacks against Israel, Saddam boasted the largest chemical-warfare-agent production facility in the Third World.[62] Hussein had also proved willing to use chemical attacks. He used chemical weapons against Iran during the Iran-Iraq War and once more against Iraq's Kurdish population.[63] Israel had been the victim of Iraqi aggression in the past and had also observed test launches of Iraq's modified Scuds, thought capable of carrying a biological or chemical warhead.[64] Further, there was nothing even the highly touted Israeli Air Force could do to stop an NBC-tipped ballistic missile. The fear of chemical attack prompted city-wide gas-mask issuance and appropriate civil defense measures in Israeli cities. It is reasonable to conclude that Saddam's past use, current capability, and hatred of Israel proved a credible enough threat to provoke increased terror in Israel's civilian population. On the other hand, it begs the question; why did Hussein not use his NBC weapons?

The reason for Saddam's non-use of his NBC weapons will likely never be discovered. For the purpose of exploring the effectiveness of the using of NBC-tipped ballistic missiles, it is worth discussion. The likely explanation of why Hussein never employed his NBC weapons was that he feared retaliation from Israel or the coalition.[65] US Secretary of Defense Richard Cheney commented "I assume (Saddam) knows that if he were to resort to chemical weapons, that would be an escalation to weapons of mass destruction and that the possibility would then exist, certainly with respect to the Israelis,

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[61] Robert M. Stein and Theodore A. Postol, "Patriot Experience in the Gulf War," *International Security*, Summer 1992, 203.
[62] *Conduct of the Persian Gulf War*, Appendix Q2.
[63] *The USAF in the Gulf War*, 6.
[64] Navias Martin S, *Going Ballistic*, 146.
[65] *Summary Report*, GWAPS, 81.

for example, that they might retaliate with unconventional weapons as well."[66] In additions to possible retaliation in kind, or worse, Saddam feared an increased coalition effort to topple his regime in the event he used unconventional weapons.[67] Clausewitz warns of the consequences of retribution that a diversion can bring. "Diversion always brings the war into an area that would otherwise have been left untouched. Enemy forces that would otherwise be dormant are consequently in some degree brought to life."[68] Perhaps propaganda touting the threat of chemical or biological use is more effective in generating terror, in contrast to facing retributions from an asymmetrically superior enemy as a result of their actual use.

The second theme encompasses an analysis of the diversionary effect of Iraq's missile campaign and whether Saddam appropriately exploited that effect. Saddam appeared ready to exploit the benefits of having both fixed and mobile Scud sites before the war even began, whereas Hitler resorted to mobile launchers out of necessity. Unknown to the coalition, Hussein dispersed his TELs to concealed wartime sites as early as August 1990. The fixed Scud-launch sites in western Iraq served to deter Israel before war, and served as decoys after the war started. Saddam meant for his fixed sites to absorb the coalition's bombs intended for his TELs or other critical areas, and by doing so increased the diversionary effects.[69]

Saddam's extensive use of his mobile launch sites amplified and extended the diversionary effect far past the use of his fixed sites. There were several advantages of the pre-planned use of TELs. First, Iraq's missile forces were able to pre-survey many launch sites, the use of which, increased Scud accuracy. Second, the TELs were only as large as a medium-sized truck and moved continually, creating location and identification issues for coalition sensors. Third, departing from the Russian doctrine that coalition planners had assumed the Iraqis would follow, the Iraqi missile forces omitted all pre-launch emissions. Further, they adopted a shoot-and-scoot tactic while minimizing set-up and tear-down time. These tactics frustrated pre-launch and post-launch detection by

[66] As quoted in Navias Martin S, *Going Ballistic*, 157.
[67] Olsen, *Strategic Air Power in Desert Storm*, 266.
[68] Carl von Clausewitz, *On War*, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), 563.
[69] *Summary Report*, GWAPS, 85.

coalition Scud patrols.[70] Fourth, the Iraqis used extensive camouflage, concealment, and deception tactics. Most notably, the Iraqis were adept at their use of decoys, placing them in sight when they expected Scud patrols overhead. The higher-fidelity, inflatable decoys could fool even a close observer.[71] Finally, the Iraqis exploited coalition weakness by employing heavy Scud fire during periods of bad weather. The coalition canceled 15% of its sorties in the first 10 days of the operation due to weather.[72] Figure 1 shows that the number of Scuds fired during that time was the highest of the war, averaging 4.7 launches per day. While the low clouds did not affect the accuracy of the Scuds, the weather did severely limit coalition sensors and laser-guided-bomb employments against TELs. Saddam's mobile launch sites did not win the war, but the coalition was never completely able to suppress their Scud fire either. And, in attempting to prevent Scud launches, the coalition was forced to modify its air campaign and expend assets for a diversion. The conclusion is that both fixed and mobile launch sites increased the diversionary effect, while the latter caused the greater effect.

[70] *Summary Report*, GWAPS, 124 and *Conduct of the Persian Gulf War*, 224.
[71] *Summary Report*, GWAPS, 124 and 138.
[72] *Conduct of the Persian Gulf War*, 227.

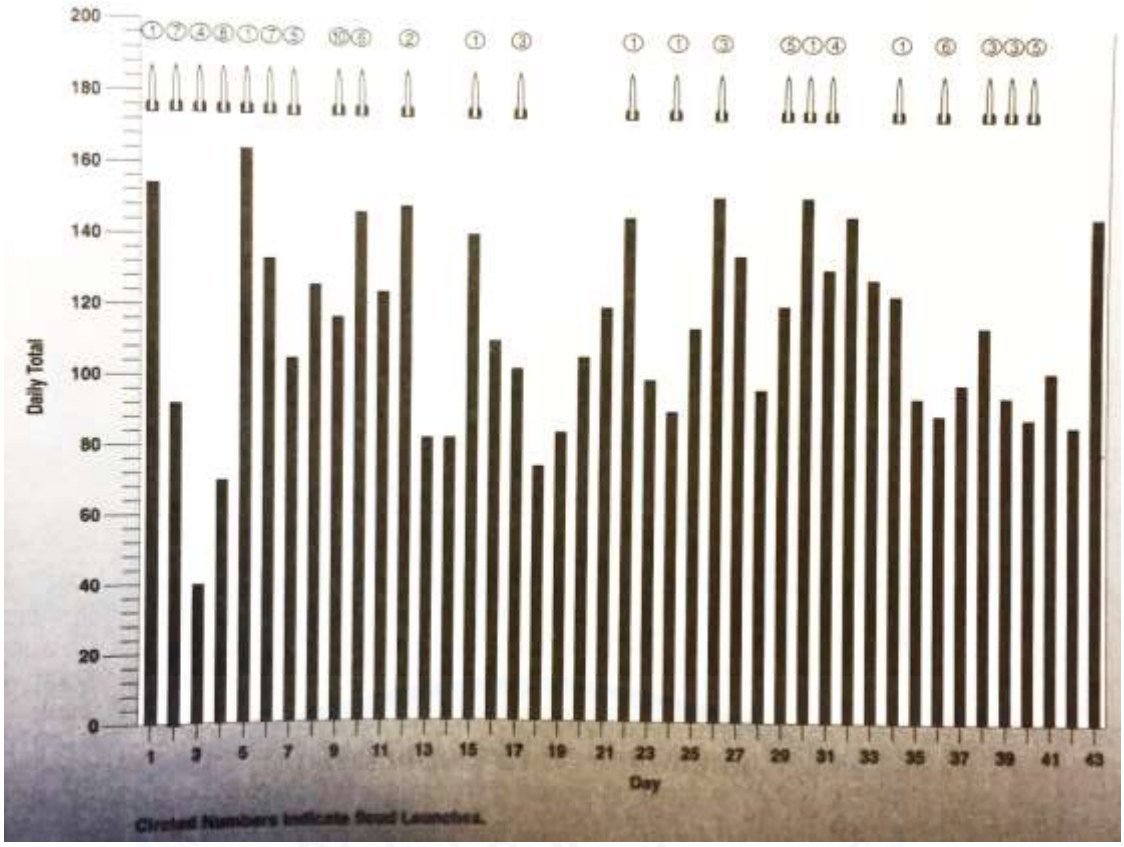

Figure 1: Estimated Scud Sorties
Source: Reprinted from The USAF in the Gulf War, 27.

The final theme includes an exploration of the cost effectiveness of Iraq's Scud use. The exact cost of Iraq's missile program is unclear for several reasons. The foremost reason is that international weapon sales are very opaque for obvious counter-intelligence reasons. Some missiles were likely acquired from like-minded countries, such as what took place in 1988 when Egypt reportedly transferred upgraded Scuds to Iraq.[73] Soviet exports and indigenously manufactured missiles comprised the majority of Iraq's missile arsenal. The USSR supplied missiles to Iraq throughout the Iran-Iraq war. Prior to that, Iraq and Russia signed a Treaty of Friendship and Co-operation in 1974 and subsequently completed a $1-billion-dollar arms deal consisting of fighter aircraft, tanks, and missiles.[74] By purchasing most of his missile arsenal from a third party, he was able to lower his research-and-development costs in a manner that Hitler was unable to do

[73] Navias Martin S, *Going Ballistic*, 84.
[74] Navias Martin S, *Going Ballistic*, 66.

with his groundbreaking V-2. Ballistic missiles are cheaper to maintain than a fleet of aircraft and do not require years of pilot training to employ. In contemporary times, off-the-shelf purchases can significantly lower or eliminate any development costs while also bringing economy of scale into play. Combined with a reasonable number of cheap mobile launchers, one can create an outsized diversion to counter an adversary possessing a massively expensive airpower advantage. While it is nearly impossible to quantify the actual costs to both Saddam and the coalition of their Scud and anti-Scud efforts, respectively, it seems reasonable to conclude that Iraq's Scud program was a cost effective diversion.

Summary

This chapter sought to investigate Saddam Hussein's use of Scud missiles during Desert Storm. Saddam's strategic objective for the use of his missiles was simply to break the coalition. He targeted Saudi Arabia in an attempt to coerce the participating governments to stop their support of the US-led coalition. He targeted Israel primarily to prompt unilateral Israeli action, thus upsetting the coalition. Saddam also sought to gain credibility among Arab fence-sitters, and exact revenge for Israel's strike against Iraq's Osirak nuclear reactor in 1981. Iraq's missiles provided the only credible means of offensive capability to achieve these strategic goals. The Iraqi army's track record against Israel did not offer a realistic chance of achieving Saddam's goals. The Iraqi Air Force had long been sidelined in favor of Iraq's missile forces. Scuds were cheaper to buy and maintain, had successfully terrorized Iran in the Iran-Iraq War, and provided credible deterrence against Iraq's regional allies, notably Iran and Israel.

Saddam's Scud campaign began hours after the start of Desert Storm. The campaign did not achieve Saddam's desired objectives, but did significantly affect the coalition's air campaign. The Scud campaign failed for several reasons. Saddam had limited quantities of missiles and the USSR ceased supplying Iraq during Desert Storm. A dearth of missiles and the coalition's anti-Scud campaign prevented the massive number of Scud attacks seen in the Iran-Iraq War. Additionally, Hussein generally overestimated the coalition's fragility while underestimating Israel's restraint. The coalition successfully sidestepped potential strategic failure of its air campaign due to the sheer quantity of coalition aircraft and opportunistic targeting schemes.

Of the targets Saddam pursued with his Scuds, the attacks against Israel's population centers were the most effective. Israel, a liberal democracy, provided its civilians with enough political levers to pressure its government to action. Also, since Israel was not part of the coalition, its temptation for unilateral action was likely greater than the other target states, Saudi Arabia and Bahrain.

The chapter explored three themes concerning the effectiveness of Saddam's Scud use. The first theme involved an in-depth look at what aspects of the Scud's employment created terror in the target population. Israel's five-minute warning concerning inbound missiles, in addition to the limited salvos, reduced the terror effect that the Scuds were meant to evoke. The Scud's notorious inaccuracy was not as much of a concern because of the belief in the Patriot missile defense system's successes. The Scud's shoddy workmanship, however, created many issues for the Patriot, but those issues were not largely known until after the war. Thus, the Scud's inaccuracy and poor construction likely did not increase the amount of terror appreciably, but could in the future dominated by near-real-time information sharing. Saddam's threat of biological- or chemical-tipped missile use created terror in Israeli populations.

The second theme comprised an exploration of the exploitation of the diversionary effect of the Scuds against the coalition's air campaign. Saddam's fixed Scud-launch sites did act as decoys and attracted bombs that could have been used elsewhere. They increased the diversionary effect somewhat, but Saddam's mobile transporter-erector launchers outpaced the fixed sites. The TEL's mobility, TEL decoys, and their shoot-and-scoot tactics diverted a significant number of strike, reconnaissance, and command-and-control aircraft. The TELs provided a survivable component that extended and amplified the diversion. The final theme concluded that Iraq's Scud campaign was a cost-effective means to reduce the asymmetry against a stronger airpower enemy. In the end, however, the Scud campaign was never a war-winning strategy, and was much more effective at creating a diversion.

Chapter 3

"The Dictator's Handbook for SSM Use" and Suggested Countermeasures

The purpose of this chapter is twofold. First, it aims to provide conclusions on theater-ballistic-missile use against an asymmetrically stronger air power. These conclusions make up "The Dictator's Handbook for SSM Use". Second, the chapter provides a cross-case comparison of the anti-missile efforts, as a means of suggesting how powers confronting the "dictators" might thwart them. The purpose is to distill historical best practices from the case studies and to set the stage for a discussion of the contemporary implications.

The following section comprises the "Handbook." It attempts to offer an engaging, satirical means to communicate the summarized lessons of SSM use from the points of view of Hitler and Saddam. The purpose of "The Dictator's Handbook" is to provide insights into how future US adversaries might make use of SSM campaigns. Of note, the term "dictator" is merely a literary tool. Its use does not imply that the following conclusions apply to one particular type of political entity.

The Dictator's Handbook for SSM Use

You are facing a technologically and numerically superior adversary. His airpower dominance is especially great. But, fear not—you have an arsenal of surface-to-surface missiles at your disposal. I offer you a plan for gaining maximum advantage from these fearsome weapons.

1. Choose an Advantageous Strategy: SSMs are best used for the strategic defensive

History has shown that SSM use against a more powerful airpower adversary will likely not win the war for you. Both Hitler and Hussein desired for their missiles to deliver strategically decisive results by providing a deep strike capability against their enemies. Both men viewed their missile forces as war-winning means, and both lost their wars. Yet, their missile campaigns drove large changes in their enemies' air campaigns by threatening politically sensitive targets, which in turn, created large and sufficiently

lengthy diversions of air assets. SSMs are ideal for buying you time by diverting adversary air resources until the moment is ripe for your main-effort counterattack. Your missile attacks will likely not achieve your long-term political objectives in war, but are sure to help deny the enemy theirs by contesting their air superiority. In other words, SSMs are best used for the strategic defensive.[1]

It should be noted that SSMs are not the only means that can accomplish a diversion of enemy air power. This handbook describes a mechanism that is well-suited for SSMs; however, any means that conform to the following principles could likely serve as a suitable substitute. Unmanned aerial or sea vehicles could perhaps substitute for or accompany missile use. The remainder of the handbook outlines special considerations to increase the probability of creating a diversion of enemy air assets.

2. Select the Right Target: aim for politically sensitive, not necessarily military significant

"The choice of enemy targets…is the most delicate operation of aerial warfare," wrote air power theorist Giulio Douhet.[2] Selecting the right target is the most important decision towards spurring an adversary airpower diversion. Clausewitz suggests that one must choose "vulnerable objectives of great importance to the enemy."[3] To maximize success, choose a target that will inflict the most terror upon the enemy's population. Also, choose a target that is physically large enough to accommodate inherent weapon inaccuracies. A large, densely populated city is an ideal target. It is true that both Hitler and Hussein targeted large cities in their missile campaigns and lost their war. But, there is a key difference in objectives to consider. They were seeking primarily punishment strategies with their missile campaigns in an effort to coerce their adversaries to

[1] Julian Corbett, *Some Principles of Maritime Strategy* (Charleston, SC: The Perfect Library, 1911), 141.
[2] Giulio Douhet, *The Command of the Air*, trans. Dino Ferrari (Washington DC: United States Government Printing Office, 1998), 59.
[3] Carl von Clausewitz, *On War*, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), 562.

capitulate. Pape's Denial Theory of Coercion predicts that pure punishment campaigns by conventional forces rarely ever work, and this proved the case for Hitler and Saddam.[4]

In contrast, Pape concludes that a denial strategy is usually the best coercive strategy for air forces.[5] However, both Hitler's and Saddam's secondary efforts at denial attacks provided less than desired results. Depending on the precision of the missile arsenal, enemy military targets may be too small or mobile to hit. More importantly, military targets may not be politically sensitive enough to evoke a massive diversion of enemy air capabilities. Military forces expect to be targeted. Civilians do not. Also, liberal democracies present especially lucrative cities for targets, as their governing bodies are typically very accommodating to their constituents' concerns about further attacks. Therefore, military targets should be attacked only as a last resort.

The ideal approach for SSMs is a punitive denial strategy.[6] SSMs are an exemplary weapon to strike a punitive target, such as a population center. The objective of the attack, however, should be to achieve denial effects by diverting enemy air assets away from their main objective to suppress further city attacks.

3. Maximize Terror: the level of terror the missiles create appears correlated to the probability of evoking a response from the enemy.

Three observations can serve you well in the realm of creating terror with SSMs. Try to avoid warning of missile attacks; spending money for increased missile accuracy is not necessarily desired; and the threat of nuclear, biological, or chemical (NBC) use is more valuable than their actual use.

Advanced warning allows the target population to seek refuge and dulls the psychological value of the missiles. Hitler's V-1s were most efficient at creating terror during their first attacks. After Londoners became aware of the weapon and their telltale buzzing noise, the weapon lost some of its terror value. The V-2 had no such audible

[4] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press, 1996), 345 and 358.
[5] Pape, *Bombing to Win: Air Power and Coercion in War*, 20.
[6] Edward B. Westermann, "The Limits of Soviet Airpower: The Bear versus the Mujahideen in Afghanistan, 1979-1989" (School of Advanced Airpower Studies, Air University, 1997), 4.

warning. Launch-detection technology at the time could not give the populace adequate warning of inbound V-2s. The V-2, therefore, continued to terrorize Londoners throughout the missile campaign, as it would strike seemingly out of nowhere at any time. During Desert Storm, the US was able to provide approximately 5 minutes of warning to Israel about inbound Scuds. The resulting psychological effects of terror against the target population largely mimicked the V-1. Israel's population viewed the Scud attacks with tremendous fear initially, but quickly adapted.

Increased missile accuracy is not necessarily desired. Attacks that appear indiscriminate increase the level of terror, and advertised inaccuracies of your missiles will surely frighten your target population further. The purchase or development of less-capable missiles could save time and money. There are two assumptions associated with this conclusion. First, it assumes that targets of a reasonable size exist to present a high chance of a successful strike. Second, it assumes that you have not sought an anti-access/area denial (A2/AD) strategy. A2/AD strategies change your calculus and are not addressed in this handbook (but will be addressed in the next chapter).

The threat of NBC use can be more effective than the actual use. The threat of NBC use can provoke high levels of terror in a population. The actual use of NBC weapons might provoke attacks of retribution, possibly leading to your regime's demise. This assertion assumes that your adversary is not only asymmetrically superior in air power capabilities, but NBC-equipped as well. It also assumes that you have credible stocks of NBC material and the capability to weaponize those stocks.

4. Live to Fire another Day: choose the right tactics for your strategy:

Both fixed and mobile missile-launch sites offer unique advantages, but mobility generally offers greater benefits. Static launch sites may be desirable depending on your needs. Expect that fixed launch sites will be targeted early in the enemy's air campaign. With minimal repair work and proper decoys, the static sites can serve as recurring targets thus diverting enemy bombs from higher value assets. Hitler exploited his large V-2 sites to lure heavy bomber formations away from his cities. Saddam also used his fixed Scud sites and decoys to lure his enemies' weapons away from more important

targets. Be aware that precision-guided munitions have reduced the level of diversionary effect that static sites provide.

Mobile sites increase the intensity and length of diversion more than static sites. Use your mobile launchers and SSMs to conduct guerilla war in the skies. War against asymmetrically powerful foes is as old as time, but adapting those unconventional methods towards air war has been an evolving process. A point of emphasis again, this strategy will not yield victory for you alone, but it may buy by you time by providing a means of strategic defense until you unveil your counterattack at a time and place of your choosing. Neither the Allies in World War II, nor the US-led coalition in Desert Storm were able to stop missile launches from mobile sites. Enemy ground invasion is the only proven method of removing the threat of mobile launchers. Also, pre-surveyed launch sites can increase accuracy nearly to the level of a fixed site. Exploit the fact that detection of mobile sites will likely remain a time-intensive task in the near future. Strict emissions control alongside camouflage, concealment, and decoy can provide greater survivability to missile forces. Surviving to fire another day is the key to a successful diversion.

A look at maritime practices of a weaker fleet provides some useful insights to guide the SSM strategy and tactics. First, avoid decisive battle with your SSM forces. Naval strategist Julian Corbett would recommend that your mobile launchers should focus on remaining "a fleet in being".[7] Prioritize survival, and then strike when the situation is in your favor. By doing so, you can seize temporary control of the air and deny it to your adversary, despite his superiority of power. Tactically, you must strike a balance between dividing your launchers and concentrating their effects. Divide your forces to conceal and hide numbers. Coordinate and mass your strikes to achieve concentration of effects upon your desired objective. "The ideal concentration…is an appearance of weakness that covers a reality of strength."[8]

5. Spend Wisely: do not bankrupt your primary effort for the sake of a diversion

[7] Corbett, *Some Principles of Maritime Strategy*, 142.
[8] Corbett, *Some Principles of Maritime Strategy*, 103.

Missiles can be a cost-effective solution to help reduce air power asymmetry with an enemy. Missiles are difficult to defend against. Most advances in missile defenses are increasingly being matched with countermeasures. Also, missile defenses can only cover so much area, leaving exposed other potentially lucrative targets. Mobile missiles will continue to plague even the most capable airpower adversaries in the near future. Despite these beneficial characteristics of SSMs, do not fall prey to their alluring rhetoric.

Advocates often tout that air power can win wars cheaper, faster, and more decisively. Hitler and Saddam fell prey to this logic and placed too much emphasis on their missiles. Hitler's V-2 program helped bankrupt his primary war effort. Saddam overestimated the decisive effects of his missiles.

Missiles can offer a version of air power that is cheaper than building and maintaining a modern manned air force. Missile funding should not, however, degrade the primary war effort. Dictators can save money in several ways. Purchasing off-the-shelf weapons limits research-and-development costs. Accepting reduced capabilities in range and accuracy can save money. Mobile launchers are more survivable and may be cheaper than constructing robust static launch-sites. Cheaply built missiles may provide an additional discount. Missiles that break apart on reentry complicate defensive systems, yet may still terrorize their civilian targets.

A final word to the wise dictator: by applying the handbook's recommendations above, your missile force can offer a solution to help level the asymmetry between you and a superior airpower adversary. Remember to choose the strategy that history suggests is most advantageous: strategic defense. Choosing the right targets is half the battle; go for the most politically sensitive ones while seeking a punitive denial mechanism through diversion. Increase the odds of creating a diversion by maximizing the terror you inflict with your missile campaign, but do not do so at the expense of sacrificing your missile forces. A mobile launcher and crew that lives to fire another day extends the diversion, and inflicting maximum terror increases the intensity of the diversion. Seek the right balance while buying time for your counterattack. Finally, do not spend money seeking a missile force at the expense of your main effort or regime

survival. Now go forth and wreak havoc on your adversaries' meticulously planned strategic air campaign!

Suggested Countermeasures

The central theme of the two case studies is that air campaign plans often overlook the need to consider politically sensitive SSM targets. Politically sensitive targets, once attacked, often require policymakers to divert resources to respond to the threat. Those ad hoc modifications to air campaigns carry the risk of strategic failure. So how does a traditionally great airpower nation confront the dictator armed with the preceding handbook strategy?

This section aims to distill the successful practices that bested Hitler and Saddam's missile diversions. Conventional wisdom suggests that Operation Crossbow and Desert Storm's Great Scud Chase created large diversions of air power. The research has shown that this is not entirely correct. The Allies and the coalition managed to overcome the potentially disastrous diversion of their air assets. Crossbow used 15 percent of the total sorties available.[9] The Great Scud Chase used only 1 percent.[10] These diversions were not trivial, but also not decisive. The importance of these percentages lies in how the Allies and coalition were able to attend to the missile threat while not losing sight of the larger objectives. Highlighting the factors behind their successes may be useful for today's theater planning and long-term procurement strategy.

The Allies in World War II applied several successful techniques to counter Hitler's V-weapon diversion. First, US political and military leaders used effective diplomacy and compromises to alleviate Britain's concerns. For example, Spaatz compromised with Churchill by agreeing to pursue Crossbow targets at the expense of his bomber-offensive objectives. Second, the Allies used opportunistic targeting. Spaatz selected Crossbow targets deep inside the European continent to provoke a Luftwaffe defensive response. He was able to achieve Crossbow objectives by striking these deep V-weapon facilities. Simultaneously he sought air superiority in preparation for Operation Overlord by attriting the German air force on those same missions. Third, the

[9] *The "Crossbow" Campaign: The Air Offensive Against the V-Weapons*, 24 Sep 1945, Call # 137-3-6-13, IRIS # 00113322, Unites States Strategic Bombing Survey, AFRHA, Maxwell AFB AL, 27.
[10] U.S. Department of the Air Force, *Summary Report*, Gulf War Air Power Survey (Washington DC: United States Government Printing Office, 1993), 184-185.

Allies exploited V-weapon weaknesses, namely their limited range, that required launch sites closer to Britain. This limitation allowed for multiple bombing missions in one day when Crossbow targets were prioritized over the Combined Bomber Offensive (CBO). Fourth, the Allies helped minimize the diversion of their air assets through innovative practices. Operations such as Aphrodite helped use repurposed or expired aircraft for the Crossbow effort. Finally, the sheer number of Allied aircraft handled the simultaneous requirements of both Crossbow and CBO missions, even during the busiest times.

The US-led coalition in Desert Storm also applied several successful techniques to counter the diversion posed by Saddam's Scuds. First, President Bush's deft diplomacy with Israeli political leaders was critical. The Bush administration set realistic expectations and ensured open communication between Tel Aviv and Washington. Open communication allowed the Israelis to fine-tune the counter-Scud air campaign to suit their needs. Second, the coalition used opportunistic targeting by retasking airborne strikers to back-up targets if Iraq's mobile launchers evaded detection. Finally, the coalition possessed excess airpower assets for the operation's multiple air requirements.

The following cross-case comparison distills several anti-SSM best practices. Strategically, both case studies share two features. First, the two cases highlighted clever diplomacy between both political and military leaders. Good diplomacy is the most important factor in minimizing the diversion and should be the first step in future counter-missile campaigns. Second, both cases show that the quantity of aircraft brought to the fight has a quality of its own. This factor will be addressed further in the next chapter. At the operational and tactical levels, both cases highlighted opportunistic targeting that minimized the diversions. Flexibility is a key tenet of air power and will continue to be important in future anti-missile campaigns.

There is one aspect of the Allied and US-led coalition responses that could stand further scrutiny. In both cases, but especially in Desert Storm, many senior military leaders initially neglected the political potential of ballistic missile-employment. This neglect caused suboptimal changes to the strategic air campaigns. During Crossbow, Spaatz continued to vigorously object to the operation's continued interference with his

bomber-offensive objectives.[11] It does not appear clear that Spaatz and other senior air officers, fully appreciated the political consequence of Britain capitulating under Hitler's V-weapon attacks. Or at least, they viewed the possibility of capitulation as miniscule because of their perception of the V-weapon as tactically ineffective.

Comments made by senior military leaders during Desert Storm further underscore the point that military leaders have often overlooked the political consequences of enemy SSM use. The commander of coalition forces, General Norman Schwarzkopf, stated that "Saddam's missiles were less dangerous than a Georgia thunderstorm."[12] The Coalition Forces Air Component Commander, Lieutenant General Charles Horner, remarked in his post-war interview, "I was very slow to grasp the political impact of the Scud."[13] Chief of Staff of the US Air Force during the war, General Merrill McPeak, commented on the lack of priority air planners had given to the missile threat when he commented, "What surprised us was that we put three times the effort that we thought we would [to destroy the missile launchers]."[14] There is a particular irony that some of the US's leading air power figures, who promoted the ability of their nation's air power to coerce their adversaries, downplayed that very threat by claiming that Saddam's Scuds posed only a nuisance. If senior military leaders continue the trend of planning for the use of SSMs against military targets while overlooking politically sensitive targets, theater plans may prove woefully inadequate in terms of required air assets.

In sum, Crossbow and the Great Scud Chase were significant, but not crippling diversions of air power, contrary to conventional wisdom. Strategically, the Allies and the US-led coalition used excellent diplomacy, and employed enough air assets, to minimize their enemy's diversion. Operationally and tactically, the Allies and the coalition executed flexible targeting. This section also addressed the disturbing trend of senior military leaders overlooking the political impact of SSM use in favor of focusing

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[11] Richard G. Davis, *Carl A. Spaatz and the Air War in Europe* (Washington, D.C: Center for Air Force History : For sale by the Superintendent of Documents, U.S. G.P.O, 1993), 296.
[12] Navias Martin S, *Going Ballistic: The Build-up of Missiles in the Middle East*, 1st English ed (London ; New York: Brassey's, 1993), 2.
[13] Oral History Interview of Lieutenant General Charles A. Horner, 2 Dec 1991, Call # K239.0472-93 C. 1, IRIS # 00876282, Desert Story Project, Miscellaneous Interviews, AHRA, Maxwell AFB AL, 16.
[14] Navias Martin S, *Going Ballistic*, 159.

on the threat to their military forces. The next chapter will place the best practices against a potential scenario to highlight potential shortfalls in US strategy, planning, and acquisitions.

Conclusions and Implications

Do US theater air plans account for the level of diversion that may occur if a surface-to-surface missile-wielding (SSM-wielding) adversary attacks civilian targets? What are the implications of a diversion with current and near-term air-asset numbers? This chapter seeks to answer these questions by applying the anti-SSM best practices to a potential future scenario. The purpose is to highlight potential US strategic vulnerabilities and areas for future research regarding airpower procurement and theater-specific plans.

The probability of high-intensity conflict between the US and China, two great powers with nuclear weapons, is unlikely but also not zero. In the event that US military forces are charged with projecting power in China, US air forces might find themselves unable to cope with a simultaneous strategic air campaign and a counter-SSM diversion. China's rocket force touts itself as one of the largest and most sophisticated arsenals of ballistic and cruise missiles in the world. China specifically funds these capabilities to compensate for its underdeveloped (relative to the US) strike-aircraft capability.[1] However, China does not suffer from the severe asymmetric airpower disadvantage that plagued 1944 Germany and 1991 Iraq. In fact, China's advanced rocket force is so capable that it is incorporated into its joint-warfare strategy. Its rocket force is designed to work in tandem with its rather capable defensively oriented air forces. Also, unlike Germany and Iraq, China employs an anti-access/area-denial strategy (A2/AD) which changes the calculus on predicting how it will use its missiles in a future conflict. China has the capability to conduct denial strikes against its enemies' force-projection entities, such as forward basing and aircraft carriers. China's A2/AD strategy presents US military planners with an obvious, albeit difficult, problem to solve. The planning should not stop there.

If a Chinese punitive denial attack is not being anticipated, then planning requirements for air assets are probably vastly inaccurate. This paper's argument should serve as a warning shot to theater planners at least to consider the repercussions of China

[1] *Chinese Strategic Weapon Systems*, Jane's Sentinel Security Assessment - China and Northeast Asia (Jane's by IHS Markit, February 28, 2017), http://janes.ihs.com.aufric.idm.oclc.org/SecurityCountryRisk/Display/1303170 (accessed 1 March 2017), 4.

using SSMs against politically sensitive, non-military targets. Unfortunately, planning is not the only potential shortcoming in this scenario.

The US could easily find itself without adequate numbers of air assets to handle the counter-missile diversion in a China scenario. Providing sufficient quantities of air assets was one of the strategic-level best practices that helped the Allies and the US-led coalition trump their adversary's diversion. Twenty-first century counter-missile campaigns may not look like those in the two case studies, and the solutions may not either. Complex air-campaign problems, like the ones in this scenario, often generate talk of third-offset strategies, multi-domain approaches, or "silver bullet" platforms such as the B-21 or F-35. The problem is that these visions of the future are not slated for realization until 2030 and beyond.[2] This raises troubling questions. Are these visions dictating the proper strategy? And what is the US to do in the interim? This author argues that in the interim a counter-missile strategy will likely mimic the recent past, notably the Desert Storm Scud hunt. If this assumption holds true, the US will see its vulnerabilities exposed in short order.

Ballistic missile defense (BMD) has come a long way since 1991, but will still have limitations. First, BMD is subject to increasingly advanced countermeasures, such as decoys, maneuvering warheads, and stealth coatings.[3] Second, even if there were enough BMD components to surround China, massive deployments of BMD to the region would not be politically viable.

A modern day Scud hunt could possibly be of such magnitude as to break the primary US air campaign. China operates both fixed and mobile missile forces, relies heavily on camouflage, concealment, and decoy use, and has thousands of missiles in its arsenal.[4] China can deny critical regional sea and land basing with its missiles. Further, China possesses a robust integrated air defense system (IADS).[5] An air campaign that requires finding mobile launchers under the protection of a modern IADS would present numerous problems for the US air forces. If one assumes that the Scud hunt would

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[2] *Air Force Future Operating Concept: A View of the Air Force in 2035* (Department of the Air Force, September 2015), http://www.af.mil/Portals/1/images/airpower/AFFOC.pdf, 1.
[3] *Chinese Strategic Weapon Systems, 11*.
[4] *Chinese Strategic Weapon Systems, 7-11*.
[5] *Chinese Strategic Weapon Systems, 18*.

require the survivability and sensors of the US's numerically limited 5th-generation fighter fleet, what capabilities would be left for the main air effort? Would the remainder of the force be able to prosecute the main strategic air campaign with reduced support of their 5th-generation wingmen? A scenario such as this could find US air forces unable to overcome the diversionary effect of a punitive-denial missile campaign from China.

The US inability to overcome a large diversion of air assets against China is unlikely to disappear in the next decade. For example, the number of fighter, bomber, and attack fixed wing aircraft in the USAF inventory in 1990 was 3,194.[6] In 2016 the number was 2,192.[7] Approximately 826 combat-coded USAF aircraft were used in Desert Storm, or about 25% of the fleet. To supply the same amount of like aircraft today would involve 37% of the fleet. The decrease in fleet numbers presents two issues. First, fleet numbers will go up with further acquisitions of new platforms such as the F-35A. But such new acquisitions are scheduled to take another decade to fulfill, and will likely remove some tried-and-true platforms, such as the A-10 and F-16. In other words, new acquisitions may solve the issue of low-fleet numbers in the future, but leave a substantial gap in the interim. The second issue is geopolitical. One could argue that the current US air fleet is more capable than that possessed in 1990, so fewer aircraft would likely be required to accomplish the feats achieved in Desert Storm. This argument is dependent on the characteristics of the future conflict's environment. China, for example, covers a land mass over twenty-one times as large as Iraq. An anti-missile campaign in China can reasonably be assumed to require many more aircraft than did Desert Storm, far beyond the increase in capabilities the fleet has amassed since Desert Storm. How has the US gotten to this point?

The USAF has suffered a loss of quantity in its fleet since 1990 for a variety of reasons. Probably chief among these is the end of the Cold War and the resulting loss of the USSR as the US's prime motivation to remain equipped to the teeth. The ensuing procurement strategies have sought efficiency at the expense of effectiveness. The 21st century has ushered in an era of irregular warfare for the US. The long conflicts the US has fought in Iraq and Afghanistan, combined with sequestration, have reduced military

[6] "State of the Force: The 1990 USAF Almanac," *Air Force Magazine*, May 1990, 50.
[7] "State of the Force: The 2016 USAF Almanac," *Air Force Magazine*, May 2016, 36.

recapitalization efforts while also prematurely wearing out the existing fleet. Further, as its adversaries correct the offset in technology that stealth offered the US for the last few decades, procurement of survivable air platforms has become more expensive. To spend defense funds efficiently, the USAF has sought to research and develop 5th-generation aircraft that stack multiple high-end capabilities onto fewer platforms. Desert Storm air-campaign planner David Deptula remarked that the, "traditional nomenclature associated with aircraft limits the understanding of air power's potential in this regard. Today, a single aircraft can already perform the functions of ISR, strike, close air support, electronic warfare, strategic attack, and others. These capabilities will only improve with the maturation of concepts for modular aircraft and fractionated systems that are minimally affected if parts of the systems are removed. For example, the F-22 and F-35 are not merely 'fighters': they are F-, A-, B-, E-, EA-, RC-22s and 35s."[8] Deptula's comments appear to promote air power theorist Giulio Douhet's concept of "battleplane", but for the modern-day.[9] The USAF's 2015 Strategic Master Plan reiterates the focus on acquiring this "high-end focused force".[10] The problem with stacking multiple high-end capabilities onto one platform is that in reality it leads to "gold-plating," or continually adjusting acquisition requirements to meet or exceed the latest technological trends. Gold-plating drives unit costs up. To spend money more efficiently, fleet acquisition numbers go down. The F-22 was the poster child for this issue. The Defense Department lowered the final purchase number to 187 units after spiraling acquisition costs.[11]

Since Desert Storm, the USAF has lowered its fighter and bomber fleets' numbers in a bid for efficient spending (Reference Figure 2 and 3). Lower fleet numbers directly influence the effectiveness of the USAF in the Pacific theater because counter A2/AD

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[8] John Andreas Olsen, ed., *Global Air Power*, 1st ed (Washington, D.C: Potomac Books, 2011), 414.
[9] Battleplane was a concept Douhet advocated calling for the production of as single, but modularly designed aircraft. The aircraft would serve as either a combat (air superiority fighter) or bomber plane depending on the mission at hand. Douhet espoused using the same crew that was trained on both missions. He also advocated the use of specialized equipment and armament that was selected as the mission dictated. The idea promoted a fighter that was too large and cumbersome to be an effective fighter, yet too underpowered and lightly defended to be a useful bomber. Douhet, 117.
[10] *USAF Strategic Master Plan* (Department of the Air Force, May 2015), http://www.af.mil/Portals/1/documents/Force%20Management/Strategic_Master_Plan.pdf, 3.
[11] *United States Air Force*, Jane's Sentinel Security Assessment - North America (Jane's by IHS Markit, February 28, 2017), http://janes.ihs.com.aufric.idm.oclc.org/SecurityCountryRisk/Display/1766624 (accessed on 2 March 2017), 1.

wars generally turn into wars of attrition.[12] Attrition wars require redundancy and quantity. Stacking multiple high-end capabilities onto one platform achieves redundancy, but does so at the expense of quantity.[13] The long-term solution will likely involve a multi-domain approach involving exquisite stand-off sensors and shooters, but that does not help in the near term. Senator John McCain recently published a White Paper that recommended a "Hi-Lo Mix" acquisition strategy for USAF and US Navy air fleets.[14] The paper acknowledges that small investments in low-end aircraft could make them more survivable and help add numbers.[15] The F-16 successfully filled this role during its career. Starting out as the Lightweight Fighter Program, it proved cheap enough to allow for mass purchases, yet modular enough to allow for subsequent planned (and unplanned) upgrades. The aircraft solution to the China scenario does not need to be manned, or even look like a traditional fighter or bomber. The solution does need to add numbers to the fleet more quickly than historical acquisition trends have allowed. The "Lo" solution needs the basic requirements of survivability and redundancy through numbers.[16] Gold

[12] Sam J. Tangredi, *Anti-Access Warfare: Countering A2/AD Strategies* (Annapolis, Maryland: Naval Institute Press, 2013), 235.
[13] Tangredi, *Anti-Access Warfare*, 244 and 247.
[14] John McCain, *Restoring American Power: Recommendations for the FY 2018-FY 2022 Defense Budget*, White Paper (United States Senate Armed Services Committee, n.d.), https://www.mccain.senate.gov/public/_cache/files/25bff0ec-481e-466a-843f-68ba5619e6d8/restoring-american-power-7.pdf, 13.
[15] McCain, *Restoring American Power: Recommendations for the FY 2018-FY 2022 Defense Budget, 13*.
[16] Brigadier General Alex Grynkewich, "The Future of Air Superiority, Part IV: Autonomy, Survivability, and Getting to 2030," *War on the Rocks*, January 18, 2017, https://warontherocks.com/2017/01/the-future-of-air-superiority-part-iv-autonomy-survivability-and-getting-to-2030/ (accessed on 2 March 2017).

plating, if necessary, is best reserved for the next generation “Hi” platform acquisitions.

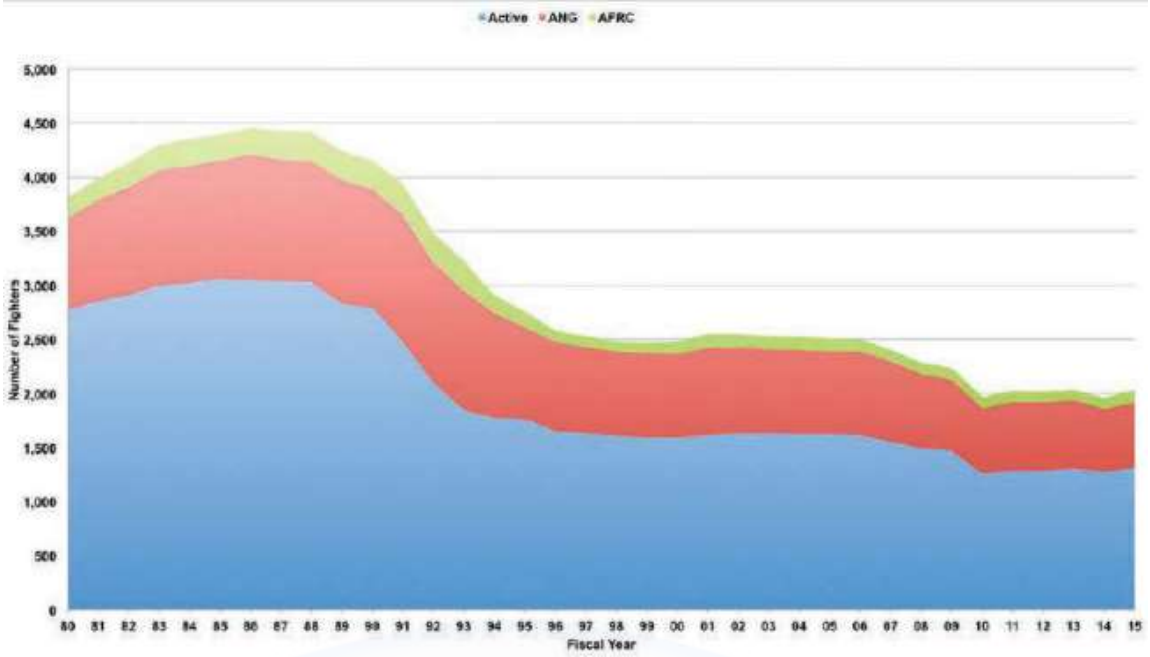

Figure 2: USAF Fighter Quantity over Time. Notice the total number of fighters in 1990 versus 2015.
Source: Reprinted from “2016 USAF Almanac,” Air Force Magazine, May 2016, 37.

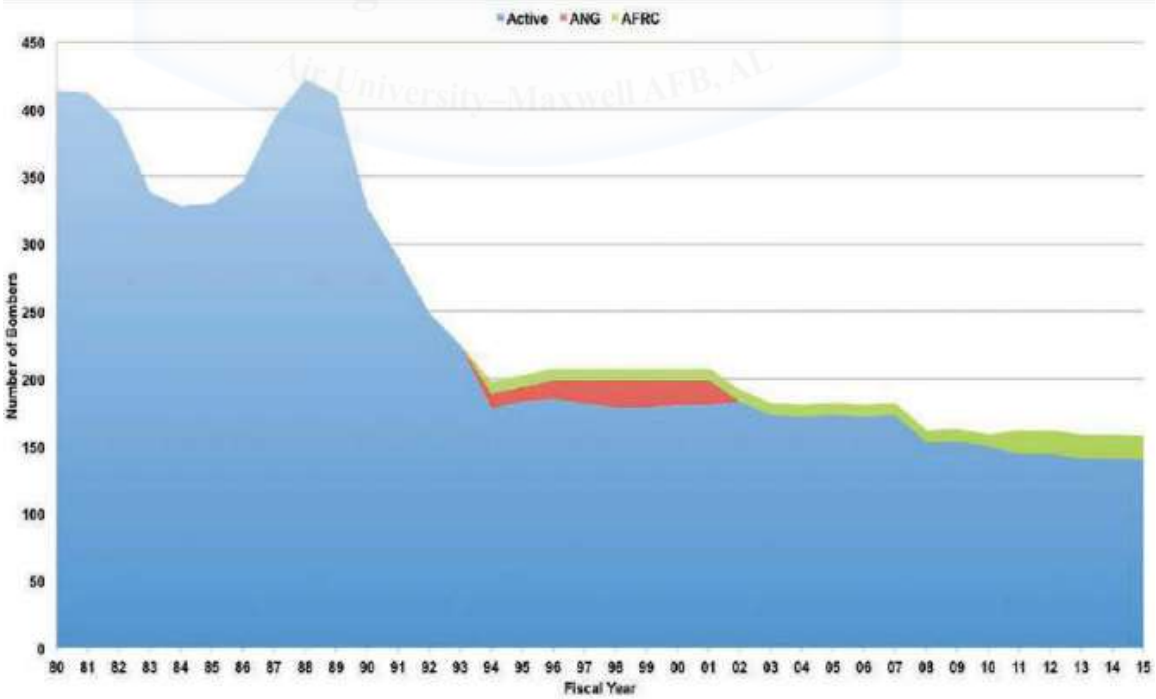

Figure 3: USAF Bomber Quantity over Time. Notice the total number of bombers in 1990 versus 2015.
Source: Reprinted from “2016 USAF Almanac,” Air Force Magazine, May 2016, 37.

The US must be prepared for another missile war. Best practices from Operation Crossbow and Desert Storm's Great Scud Chase suggest two strategic imperatives. First, the US must be prepared to conduct superb diplomatic efforts. Second, the US must procure sufficient air power assets to absorb any required diversion of air forces. The proposed China scenario suggests that this second imperative is where the US is currently vulnerable. Are planners dedicating enough thought towards protecting politically sensitive targets in addition to the more obvious military ones? If not, planned force requirements do not reflect a likely future. The current and near-term USAF fleet size cannot accommodate a significant diversion. The US cannot permit aspiring "dictators" to gain the upper hand. Potential solutions make excellent topics for further research. New capabilities do not have to be gold-plated, but money will none the less need to be spent on a solution. To help avoid war, one must prepare for war.

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